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CCT-K3: Key Comparison of Realizations of the ITS-90 over the Range 83.8058 K to 933.473 K

B. W. Mangum, G. F. Strouse, and W. F. Guthrie

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[1] At Boulder, CO 80303.

[2] Some elements at Boulder, CO.

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Key Comparison 3
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CONTENTS

Abstract 1
1. INTRODUCTION 1
2. LABORATORIES PARTICIPATING IN KEY COMPARISON 3 1
3. DEVICES USED IN THE COMPARISON 2
3.1. SPRTs 2
3.2. Transfer Cells 4
3.2.1. Gallium Cells 4
3.2.2. Cadmium cells 5
3.2.3. Ancillary Components Accompanying the Cells and SPRTs 6
4. PARTICIPANTS' INSTRUMENTATION, FIXED-POINT CELLS, TECHNIQUES AND OTHER DETAILS 7
5. RESULTS OF COMPARISONS 7
5.1. Immersion Results Provided by the Participants 7
5.2. Results of Measurements at Fixed Points 7
5.3. Data Analysis for Comparison of Fixed-Point-Cells 10
5.4. Results of Direct and Indirect Comparisons of Ga Cells 20
5.5. Results of Direct and Indirect Comparisons of Cd Cells 21
6. DISCUSSION 21

Tables

Table 1. NIST direct comparison of the gallium cells ... 23
Table 2. NIST direct comparison of the cadmium cells ... 24
Table 3. *W* values, their range and the uncertainty of measurements at the fixed points:
(Hart Model 5681, s/n 1094) ... 26
(Hart Model 5681, s/n 1098) ... 27
Table 4. *W* values, their range and the uncertainty of measurements at the fixed points:
(Rosemount Model 162 CE, s/n 4386) ... 28
(Hart Model 5681, s/n 1032) ... 29
(Isotech Model 0670, s/n 040) ... 30
Table 5. *W* values, their range and the uncertainty of measurements at the Fixed points:
(Rosemount Model 162 CE, s/n 4385) ... 31
(Hart Model 5681, s/n 1030) ... 33
Table 6. Differences in realization of ITS-90 between Lab X and BIPM ... 35
Table 7.. Differences in realization of ITS-90 between Lab X and BNM/INM ... 48
Table 8. Differences in realization of ITS-90 between Lab X and IMGC ... 62
Table 9. Differences in realization of ITS-90 between Lab X and KRISS ... 71
Table 10. Differences in realization of ITS-90 between Lab X and MSL ... 81
Table 11. Differences in realization of ITS-90 between Lab X and NIM ... 91
Table 12. Differences in realization of ITS-90 between Lab X and NIST ... 101
Table 13. Differences in realization of ITS-90 between Lab X and NML ... 107
Table 14. Differences in realization of ITS-90 between Lab X and NPL ... 119
Table 15. Differences in realization of ITS-90 between Lab X and NRC ... 133
Table 16. Differences in realization of ITS-90 between Lab X and NRLM ... 142
Table 17. Differences in realization of ITS-90 between Lab X and PTB ... 159
Table 18. Differences in realization of ITS-90 between Lab X and SMU ... 178
Table 19. Differences in realization of ITS-90 between Lab X and VNIIM ... 191
Table 20. Differences in realization of ITS-90 between Lab X and VSL ... 202
Table 21. Summary of differences of realizations and their uncertainties between laboratories for Al ... 211
Table 22. Summary of differences of realizations and their uncertainties between laboratories for Zn ... 212
Table 23. Summary of differences of realizations and their uncertainties between laboratories for Cd ... 213
Table 24. Summary of differences of realizations and their uncertainties between laboratories for Sn ... 214
Table 25. Summary of differences of realizations and their uncertainties between laboratories for In ... 215
Table 26. Summary of differences of realizations and their uncertainties between laboratories for Ga ... 216
Table 27. Summary of differences of realizations and their uncertainties between laboratories for Hg ... 217

Table 28. Summary of differences of realizations and their uncertainties between laboratories for Ar 218
Table 29a. Direct and bilateral comparison results for the gallium melting point 219
Table 29b. Indirect and bilateral comparison results for the gallium melting point 219
Table 30a. Direct and bilateral comparison results for the cadmium freezing point 220
Table 30b. Indirect and bilateral comparison results for the cadmium freezing point 220

Figures

Figure 1. The resistance of SPRT 4385 (Rosemount 162 CE) at the triple point of water as obtained by the participants during the course of the comparison 221
Figure 2. The resistance of SPRT 1030 (Hart Model 5681) at the triple point of water as obtained by the participants during the course of the comparison 221
Figure 3. The resistance of SPRT 4386 (Rosemount 162 CE) at the triple point of water as obtained by the participants during the course of the comparison 222
Figure 4. The resistance of SPRT 1032 (Hart Model 5681) at the triple point of water as obtained by the participants during the course of the comparison 222
Figure 5. The resistance of SPRT 1094 (Hart Model 5681) at the triple point of water as obtained by the participants during the course of the comparison 223
Figure 6. The resistance of SPRT 1098 (Hart Model 5681) at the triple point of water as obtained by the participants during the course of the comparison 223
Figure 7. The resistance of SPRT 040 (Isotech Model 0670) at the triple point of water as obtained by NML and NRLM during the course of the comparison 224
Figure 8. Range of W(Al) values, expressed in mK equivalents, by laboratory and SPRT 225
Figure 9. Range of W(Zn) values, expressed in mK equivalents, by laboratory and SPRT 225
Figure 10. Range of W(Cd) values, expressed in mK equivalents, by laboratory and SPRT 226
Figure 11. Range of W(Sn) values, expressed in mK equivalents, by laboratory and SPRT 226
Figure 12. Range of W(In) values, expressed in mK equivalents, by laboratory and SPRT 227
Figure 13. Range of W(Ga) values, expressed in mK equivalents, by laboratory and SPRT 227
Figure 14. Range of W(Hg) values, expressed in mK equivalents, by laboratory and SPRT 228
Figure 15. Range of W(Ar) values, expressed in mK equivalents, by laboratory and SPRT 228
Figure 16. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Al freezing point 229
Figure 17. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Zn freezing point 232
Figure 18. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Cd freezing point 235
Figure 19. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Sn freezing point 238
Figure 20. Differences, with U (95 %), in ITS-90 realizations between laboratories at the In freezing point 241
Figure 21. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Ga melting point 244
Figure 22. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Hg triple point 247
Figure 23. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Ar triple point 250

Figure 24. Direct, indirect and bilateral comparison results for the gallium melting point 253
Figure 25. Direct, indirect and bilateral comparison results for the cadmium freezing point 254

Appendices

Appendix I. Instructions Provided to Participants 255

Appendix II. Instrumentation and Experimental Details 260

Table II.1. Details of participants' instrumentation used in key comparison 3 261
Table II.2.1. Details of participant's Al cells and their respective furnaces, etc. 263
Table II.2.2. Details of participant's Zn cells and their respective furnaces, etc 266
Table II.2.3. Details of participant's Cd cells and their respective furnaces, etc. 269
Table II.2.4. Details of participant's Sn cells and their respective furnaces, etc. 272
Table II.2.5. Details of participant's In cells and their respective furnaces, etc. 275
Table II.2.6. Details of participant's Ga cells and their respective furnaces, baths, etc. 278
Table II.2.7. Details of participant's TPW cells and their respective baths, etc. 281
Table II.2.8. Details of participant's Hg cells and their respective cryostats, baths, etc. 284
Table II.2.9. Details of participant's Ar cells and their respective cryostats, etc. 287
Table II.3.1. Details of participant's techniques of realization of the freezing-point temperature of A1 290
Table II.3.2. Details of participant's techniques of realization of the freezing-point temperature of Zn 296
Table II.3.3. Details of participant's techniques of realization of the freezing-point temperature of Cd 299
Table II.3.4. Details of participant's techniques of realization of the freezing-point temperature of Sn 302
Table II.3.5. Details of participant's techniques of realization of the freezing-point temperature of In 305
Table II.3.6. Details of participant's techniques of realization of the melting-point or triple-point temperature of Ga 308
Table II.3.7. Details of participant's techniques of realization of the triple-point temperature of H_2O 311
Table II.3.8. Details of participant's techniques of realization of the triple-point temperature of Hg 314
Table II.3.9. Details of participant's techniques of realization of the triple-point temperature of Ar 317

Appendix III. Immersion Curves 320

Figure III.1 Immersion curves for the various participants for Al 322
Figure III.2 Immersion curves for the various participants for Zn 324
Figure III.3 Immersion curves for the various participants for Cd 326
Figure III.4 Immersion curves for the various participants for Sn 327
Figure III.5 Immersion curves for the various participants for In 329

Figure III.6 Immersion curves for the various participants for Ga 331
Figure III.7 Immersion curves for the various participants for H_2O 333
Figure III.8 Immersion curves for the various participants for Hg 334
Figure III.9 Immersion curves for the various participants for Ar 336

Appendix IV. Uncertainty Budgets 337

Table IV.1(a). The uncertainty budget reported should include the following: components of uncertainty budget for the triple point of water 338
Table IV.1(b). The uncertainty budget reported should include the following: components of uncertainty budget for *W* at the triple point/melting point/freezing-point, as appropriate, of Ar, Hg, Ga, In, Sn, Cd, Zn and A1 339
Table IV.1(c). The uncertainty budget reported should include the following: uncertainty budget for the comparison of fixed-point cells 340
Table IV.2. BIPM uncertainty budget for the gallium melting point and the triple point of water, expressed in mK 341
Table IV.3(a). BNM-INM uncertainty budget for the fixed points other than the triple point of water, expressed in mK 342
Table IV.3(b). BNM-INM uncertainty budget for the triple point of water, expressed in mK. 344
Table IV.4(a). IMGC uncertainty budget for the fixed points other than the triple point of water, expressed in mK 345
Table IV.4(b). IMGC uncertainty budget for the triple point of water, expressed in mK 346
Table IV.5(a). KRISS uncertainty budget for the fixed points other than the triple point of water, expressed in mK 347
Table IV.5(b). KRISS uncertainty budget for the triple point of water, expressed in mK 348
Table IV.6(a). MSL uncertainty budget for fixed points except the triple point of water, expressed in mK. 349
Table IV.6(b). MSL uncertainty budget for the triple point of water, expressed in mK. 350
Table IV.7(a). NIM uncertainty budget for the fixed points other that the triple point of water, expressed in mK 351
Table IV.7(b). NIM uncertainty budget for the triple point of water, expressed in mK 352
Table IV.8(a). NIST uncertainty budget for the fixed points other that the triple point of water, expressed in mK 353
Table IV.8(b). NIST uncertainty budget for the triple point of water cell, expressed in mK 354
Table IV.9. NML uncertainty budget for the fixed points, expressed in μK. 355
Table IV.10. NPL uncertainty budget for the fixed points, expressed in mK. 358
Table IV.11. NRC uncertainty budget for the fixed points, express in mK 359
Table IV.12(a). NRLM uncertainty budget for fixed points except the triple point of water, expressed in mK. 360
Table IV.12(b). NRLM uncertainty budget for the triple point of water, expressed in mK. 361
Table IV.13(a). PTB uncertainty budget for the fixed points other than the triple point of water, expressed in mK 362
Table IV.13(b). PTB uncertainty budget for the triple point of water, expressed in mK. 363

Table IV.14(a). SMU uncertainty budget for the fixed points other than the triple point of water, expressed in mK. 364
Table IV.14(b). SMU uncertainty budget for the triple point of water, expressed in mK. 365
Table IV.15(a). VNIIM uncertainties for the fixed points, except the triple point of water, expressed in mK. 366
Table IV.15(b). VNIIM uncertainties for the triple point of water, expressed in mK. 367
Table IV.16. VSL uncertainties ($k = 1$) for the fixed points, expressed in mK 368

Appendix V. Control Charts 369

Appendix VI. Additional Tables 372

Table VI.1. Standard uncertainties for a single measurement ($n = 1$) for the fixed points used for the various participants 372
Table VI.2. Standard uncertainties quantifying potential changes in SPRTs that were used in KC 3. The associated degrees of freedom (*DF*) are given also 375
Table VI.3. Actual coverage probabilities for expanded uncertainties with different coverage factors and different degrees of freedom 376

Appendix VII. Comments by Participants on Key Comparison Reference Values 377

Abstract

This is a report to the Comité Consultatif de Thermométrie (CCT) on Key Comparison 3, i.e., the comparison of realizations of the ITS-90 over the range 83.8058 K to 933.473 K. The differences in the realizations of the various fixed points in this range of the ITS-90 and the uncertainties of those differences are given for the 15 standards laboratories participating in the comparison.

1. INTRODUCTION

This is a report to the Comité Consultatif de Thermométrie (CCT) on the key comparison of the realizations of the ITS-90 over the temperature range from 83.8058 K (triple point of Ar) to 933.473 K (freezing point of Al). This comparison involved measurements in 15 standards laboratories. Artifacts that were circulated among the participating laboratories were one, and in some cases two, standard platinum resistance thermometers (SPRTs), a sealed gallium triple-point cell, and a sealed cadmium freezing-point cell. With the exception of one rather unusually-long SPRT that went from one of the sub-coordinating laboratories to one of the participating laboratories, the SPRTs and the fixed-point cells were supplied by the National Institute of Standards and Technology (NIST).

The coordinating laboratory for this comparison was NIST. There were two sub-coordinating laboratories, National Measurement Laboratory (NML) of Australia for the Asia/Pacific area participants and Physikalisch-Technische Bundesanstalt (PTB) of Germany for some of the European participants.

The instructions to the participants are given in Appendix I.

2. LABORATORIES PARTICIPATING IN KEY COMPARISON 3

Coordinating laboratory – NIST
    Sub-coordinating laboratories – NML and PTB

Laboratories performing comparisons directly with NIST
    NML, PTB, NMi/VSL, NRC, IMGC

Laboratories performing comparisons directly with NML
    MSL, NRLM, KRISS, NIM

Laboratories performing comparisons directly with PTB
    VNIIM, BNM-INM, SMU, NPL
        BIPM - special category, with measurements at Ga and H_2O only

For the various laboratories, the persons involved in the comparisons were:

NIST	B. W. Mangum, G. F. Strouse and W. F. Guthrie (statistician)
NML	J. Connolly
PTB	E. Tegeler, U. Noatsch, D. Heyer, B. Fellmuth and B. Thiele-Krivoj
MSL	J. V. Nicholas (now deceased), D. R. White and T. D. Dransfield
NRLM	K. Nara
KRISS	K. S. Gam, K. H. Kang and Y.-G. Kim
NIM	Y. Duan and Y. Qu
VNIIM	A. I. Pokhodun, N. P. Moiseeva and A. G. Ivanova
BNM-INM	E. Renaot, Y. Hermier and G. Bonnier
SMU	S. Duris
NPL	R.L. Rusby, J. Gray, F. J. M. Sutton and D. I. Head
BIPM	R. Pello and M. Stock
NMi/VSL	M. de Groot and J. Dubbeldam
NRC	K. Hill
IMGC	P. Marcarino

3. DEVICES USED IN THE COMPARISON

In preparation for the comparison, NIST constructed and evaluated the Ga and Cd fixed-point cells to be used by the participants of the comparison. In addition, NIST evaluated the SPRTs to be used in the comparison.

It is well known that the temperature of the triple point of water, determined in cells prepared with water from different sources and/or purified by different methods, has the potential of exhibiting fairly large differences due to isotopic composition (as large as 0.25 mK). Since the isotopic composition of Ga samples from widely different sources and of different purities is independent of sample, a Ga cell was circulated among the participating laboratories to try to ascertain how closely the triple-point/melting-point temperature of the various participants' Ga cells and the realizations of their own Ga point agree and if Ga might be a better reference point than the triple point of water for SPRT resistance ratios.

Since the Cd freezing-point temperature (321.069 °C) is a convenient value for it to be used as a check on the measurement process of calibrating SPRTs over the range from 83.8058 K to either 419.527 °C or 660.323 °C, and as a means of determining the non-uniqueness at that point, a NIST Cd cell was circulated among the participating laboratories to try to ascertain how closely the freezing-point temperatures of the various participants' Cd cells and their realizations of the Cd point agree. Unfortunately, it was discovered that only seven participants had Cd fixed-point cells of their own.

3.1. SPRTs

After the SPRTs had been selected for use in the comparison and had been annealed at 675 °C until their resistance at the triple point of water (TPW) was repeatable to < 0.2 mK, they underwent three complete calibrations. For these calibrations, all of the defining fixed points throughout the range from 83.8058 K to 933.473 K were used. During each of the three calibration cycles, the SPRTs were calibrated also at the Cd freezing point. For the three calibrations, the range of values of W {[$W \equiv R(T_{FP})/R(273.16\ K)$], where $R(T_{FP})$ is the resistance of the SPRT at a fixed-point temperature T_{FP} and $R(273.16\ K)$ is its resistance at the TPW}, was no greater than the equivalent of 0.35 mK at any of the fixed points. The range of values of $R(273.16\ K)$ over the three calibrations was no greater than 0.68 mK.

Figures 1 through 6 show the resistances of the various SPRTs at the TPW obtained during their annealing and calibrations at the fixed points, as measured at NIST before and after the other participants of the comparison, and also as reported by the participants. The first set of NIST values in each figure shows the variations among the values obtained during calibration of the SPRT after the SPRT had been annealed. The last set of NIST values in each figure includes all measurements of the SPRT at the TPW after the SPRT was received from the last participant. Upon receipt of the SPRT from the last participant, the SPRT resistance was measured at the TPW once, and in some cases several times, before annealing. These results (obtained before annealing) are shown in the figures as open symbols and are not considered in the range of values given for the SPRT that were obtained during calibration. All values reported by the participants are indicated in the figures and those obtained during annealing are indicated by open symbols. The effects of annealing on the resistance of the SPRTs are obvious. Similar to Figures 1 through 6, Figure 7 shows results for the SPRT that was measured only at NML and NRLM.

It is well known that the Pt wire of SPRT elements undergoes oxidation at temperatures below about 420 °C and breakdown of the oxide layer at temperatures above about 420 °C. The process is reversible and the breakdown occurs fairly rapidly at temperatures of 450 °C and above. Thus, compared to the value of $R(273.16\ K)$ obtained soon after annealing and just before measurements at the Al freezing point and/or the Zn freezing point, the value of $R(273.16\ K)$ obtained immediately following measurements at either of these points is normally about the same, or it is slightly smaller (0.1 mK to 0.2 mK). If the SPRT had been at room temperature for a number of hours since being exposed to heat treatment at 450 °C or higher before measurement at the TPW, then the TPW value obtained after measurements at the Al or Zn freezing point will be slightly smaller. Also, it is normal to observe some slight increases in the $R(273.16\ K)$ following measurements at Cd, Sn, In and even Ga, compared to the value obtained before measurements at either of these points. Thus, during a calibration starting at the Al freezing point in which the SPRT is at, or near, the fixed-point temperature for about 1.5 h, one should expect the $R(273.16\ K)$ measured immediately after measurements of the SPRT at the freezing points of Cd, Sn and In to increase, and maybe even increase a bit after the Ga melting point. As stated above, these rather small reversible changes in $R(273.16\ K)$ during the calibration of an SPRT are to be expected and, in our opinion, should not be classified as instabilities. Such reversible changes that occur during calibration, however, should not be greater than a total of about 0.5 mK to 0.7 mK. Changes greater than these are likely due to the other causes. If mechanical strains are somehow introduced during the measurement process, annealing at about 675 °C should remove all but the most severe and the $R(273.16\ K)$ should return to a value approximately the same as that observed before the strains were introduced. In calibrations of SPRTs, it is very important that measurements at the triple point of water are made on the same oxidation state of the SPRT as that existing at the preceding temperature of interest. If an SPRT is unstable, due to mechanical problems with the Pt sensing element or its support, say, it is our opinion that the instability likely will be observed during measurements in any laboratory.

Referring to Figures 1 through 6, one can see that the ranges of values obtained for a given SPRT during its calibrations at some laboratories, after annealing, were somewhat smaller than those obtained in the other laboratories. The reason for the difference in behavior is not likely to be instability of the SPRTs, as we define the term. Consequently, the cause must be related in some way to the techniques used by the participants, including those used by NIST.

The value of the realized ohm may be slightly different in the different laboratories so the absolute value of $R(273.16\ \mathrm{K})$ will reflect that difference.

3.2. Transfer Cells

3.2.1. Gallium Cells

The NIST reference cell, designated cell Ga 94-3 and against which the Ga transfer cells were compared, contains 99.999 99_5% pure Ga.

The Ga transfer cells that were used in the comparison contained Ga of 99.999 99+% purity. The Ga was contained in a Teflon crucible of the usual NIST design. The Teflon crucible contained a Teflon cap through which the thermometer re-entrant well assembly was inserted. The crucible was located in a borosilicate glass holder. For the first cells constructed for this comparison, this holder also contained a borosilicate glass re-entrant thermometer well, as an integral part. This crucible container was evacuated before being sealed. Thus, the Ga transfer cells that were a part of the comparison were Ga triple-point cells.

The Ga cell that was initially sent to NML for circulation among the laboratories of its participants did not survive shipment to NML. Its re-entrant well tube was broken at its junction with the outer glass envelope. After several unsuccessful attempts at repairs, a cell plus enclosure that included a one-piece Nylon cap and re-entrant well was designed at NIST. This cap assembly was attached to the outer glass envelope of the cell by a clamp, with an O-ring seal between the cap and the glass envelope that was suitable for maintaining a vacuum in the cell. A valve attached to the cap permitted evacuation of the cell. Later in the comparison, it was discovered that during air shipment of the cells a small amount of air would leak into the cells. Presumably, that was caused by contraction of the Nylon cap and the O-ring due to the low temperatures in the cargo bay of the airplanes transporting the cells. Such contraction would loosen the cap sufficiently to let air leak slowly past the O-ring seal. Although the leaks were not large enough for the cells to come to atmospheric pressure during the flights, the effects were detectable in the triple-point temperatures of the cells. Once this problem of leaks developing during transportation of the cells was detected, the cell could be easily returned to its initial condition by the participating laboratory simply by evacuating the cell upon its receipt from the airline.

The Ga cell with a one-piece glass re-entrant well tube and outer envelope that was initially sent to PTB for circulation among the laboratories of its participants survived the transportation to, and measurements at, PTB, VNIIM and BNM/INM but was broken during measurements at SMU. NIST then provided a new Ga cell of the new Nylon cap design described above for the completion of measurements at PTB, NPL, BIPM and the final measurements at PTB.

The Ga cell that was circulated among NIST, NMi/VSL, NRC and IMGC was of the Nylon cap design. The cell was hand-carried during ground transportation to and from NRC so no problem of the cell admitting air into its vacuum space was encountered before the NRC measurements, or after their measurements and the cell's transportation back to NIST. A change in the cell's fixed-point temperature was detected at IMGC, however, upon direct comparison measurements of the cell with the IMGC cell, and again at NIST upon the cell's return to NIST and direct comparison measurements with the reference cell at NIST. Consequently, in both cases the cell was evacuated to ensure that the triple-point temperature would be obtained. Since the results of comparisons of the NIST cell with the NMi/VSL cell were not reported to NIST until some months after the cells and SPRTs used in the comparison had been returned to NIST, it is not known to what extent there might have been leakage into the cell during its shipment to NMi/VSL. Upon the return of the cell from NMi/VSL, however, direct comparison of the cell with the NIST reference cell, before the transfer cell was evacuated, indicated that the 'triple-point' temperature of the transfer cell was 0.07 mK colder than that of the NIST reference cell. This indicates that air had leaked into the cell but it is unknown as to how much of the change occurred before measurements at NMi/VSL. After evacuation of the cell, its triple-point temperature agreed with that of the NIST reference cell to within 0.01 mK.

With the exception of cell Ga 961, which contained a glass re-entrant well tube and that was broken during measurements at SMU, the triple-point temperatures of the Ga transfer cells were directly compared with the NIST reference cell before and after measurements on them by the participants. As indicated above, after the cells were returned to NIST, preliminary direct-comparison measurements were made on them to get an indication of any loss of vacuum and then they were evacuated. The direct comparisons of the newly-evacuated transfer cells showed that their triple-point temperatures were within 0.01 mK of that of our reference cell. Thus, the triple-point temperatures of the cells at the completion of the comparisons were unchanged from their original values. This indicates that the transfer cells had not become contaminated during the key comparison, although air had leaked into the cells during airplane transportation. The results of the direct comparisons at NIST before and after the comparisons by the other participants are given in Table 1.

3.2.2. Cadmium Cells

The Cd cells that were used in the comparison contained 99.999 99% pure Cd. The new NIST laboratory reference cell (designated Cd 96-3) contains 99.999 99% pure Cd also and was one of five cells constructed at the same time (all of the same lot) before the key comparison began. Four of those five cells were the cells circulated among participants in the key comparison. The cells sent to the participants were sealed under a pressure of one standard atmosphere of argon gas (at the Cd freezing-point temperature). Those cells were directly compared at NIST with a cell containing 99.9999% pure Cd before measurements on them by the participants. Upon their return from the participants, the cells were directly compared with our new Cd reference cell (Cd 96-3). The W values of the cells, obtained following measurements by the participants, were found to be unchanged from those before measurements by the participants to within the repeatability of measurements at NIST, i.e., to within 0.03 mK ($k = 2$). The results of the comparison measurements at NIST on the Cd transfer cells relative to the NIST 99.9999% pure Cd cell and relative to our new Cd reference cell (Cd 96-3) are given in Table 2.

Four Cd cells were damaged during the comparison. After measurements had been completed at VNIIM and the cell returned to PTB, it was discovered that a small amount of Cd metal was located between the graphite crucible and the glass enclosure. The cell was returned to NIST where it was opened, the ingot of Cd metal removed from the crucible and placed in another (new) graphite crucible, the cell reassembled and then compared to our reference cell. The freezing-point temperature of the repaired cell was unchanged (to within our measurement repeatability) from the value of the original cell. In the meantime, a spare cell had been sent to PTB. That second cell survived measurements without incident at PTB, SMU, PTB, NPL and PTB. At the time of the comparison, BNM-INM did not have a Cd cell and made no measurements on the NIST Cd cell. During final shipment of the cell from PTB to NIST, however, rough handling by the shipper broke the very bottom part of the cell's glass enclosure, but did no damage to the crucible. The crucible of Cd was removed from the broken cell and placed in a new glass enclosure. The cell was then compared with the NIST reference cell. To within the NIST measurement repeatability (0.03 mK for $k = 2$), the freezing-point temperature of the sample was unchanged from its value obtained before its shipment to PTB. This repaired cell was then sent to NRC and later to IMGC. During return shipment of the cell from IMGC, just as in the case of the cell shipped from PTB, rough handling by the shipper broke the very bottom part of the cell's glass enclosure, but did no damage to the crucible. The crucible of Cd was removed from the broken cell and placed in a new glass enclosure. The cell was then compared with the NIST reference cell. To within our measurement repeatability (0.03 mK for $k = 2$), the freezing-point temperature of the sample was unchanged from its value obtained before its shipment to IMGC.

Upon return of the Cd cell from NMi/VSL, its condition was very similar to that of the cell returned from VNIIM, as described above. That is to say, there was Cd metal between the graphite crucible and the glass enclosure. The cell was repaired and then compared with the NIST reference cell. To within our repeatability (0.03 mK for $k = 2$), the freezing-point temperature of the sample was unchanged from its value obtained before shipment of the cell to NMi/VSL.

3.2.3. Ancillary Components Accompanying the Cells and SPRTs

For the convenience of each set of participants in obtaining good thermal contact of the Rosemount SPRT accompanying a Ga transfer cell with the liquid-solid interface of the Ga sample, an Al bushing was provided by NIST for use when the participants were making measurements with that SPRT in that Ga transfer cell. Similarly, an Al bushing to be used in a Cd transfer cell with the accompanying Rosemount SPRT was provided by NIST for each set of participants to use when they were making measurements with the Rosemount SPRTs in that Cd transfer cell. Additionally, a special heater and thermistor were provided with the Ga transfer cell for use in preparing the inner liquid-solid interface in that cell. Bushings for the participants' cells were not provided since the diameters of the re-entrant thermometer wells of the participants' cells were unknown to NIST staff. Furthermore, it was expected that the participants normally use such bushings and would provide their own special-size bushings for their particular Ar, Hg, H_2O, Ga, In, Sn, Cd, Zn and Al cells. Also, it was expected that a light mineral oil would be used in the re-entrant thermometer well of a Ga cell to improve the thermal contact of the SPRT with the inner liquid-solid interface of the metal.

4. PARTICIPANTS' INSTRUMENTATION, FIXED-POINT CELLS, TECHNIQUES AND OTHER DETAILS

The details of the participants instrumentation, their fixed-point cells, their samples, their furnaces and/or baths, their techniques for preparing freezes or melts, and other relevant information are given in Appendix II.

5. RESULTS OF COMPARISONS

5.1. Immersion Results Provided by the Participants

Although special bushings for use with a Rosemount SPRT to improve thermal contact in the Ga and Cd transfer cells were provided by NIST for each set of participants to use when they were making measurements with the Rosemount SPRTs in those cells, reports from the participants indicate that many of them did not use the bushings. Reports from the participants indicate also that many of them did not use the special heater with a thermistor thermometer provided by NIST with the Ga transfer cell for the convenience of the participant in preparing the inner liquid-solid interface in that, or their own, cell. Furthermore, some participants did not use a liquid in the thermometer well of the Ga cells to improve thermal contact between the SPRT and the liquid-solid interface of the Ga. The alternative (non-protocol) techniques used by some of the participants may very well have contributed to errors and increased uncertainties in their measurements. In fact, it is rather likely that some of the participants did not prepare an *inner* liquid/solid interface in the Ga cell. This latter situation can lead to improper immersion and, consequently, poor-quality results.

The immersion curves provided by the participants for SPRTs in their fixed-point cells are presented in Fig. III.1 through Fig. III.9 in Appendix III. Not all participants provided immersion data, although they were requested to do so in the instructions to the participants (see Appendix I). Those not providing immersion curves were: BIPM, BNM-INM, MSL (except of NIST Cd) and NMi/VSL. Information provided by BNM-INM and BIPM on immersion in their cells are given in Appendix III.

5.2. Results of Measurements at Fixed-Points

Although the comparison was designed to cover the range from 83.8058 K to 933.473 K, not all of the participants had the capability to make comparisons over the entire range. The list of W values in Tables 3, 4 and 5 specify the fixed points used by a given participant. In these tables we also list the mean W values and their uncertainties. The uncertainties listed are combined uncertainties with a coverage factor of $k = 1$ and are expressed as the temperature equivalent. The uncertainties are given as reported by the participants for each SPRT, or SPRTs, circulated among the given set of participants but adjusted for the number of W values obtained from different freezes (or melts, as appropriate) at each fixed point (see Section 5.3). When a participant sent the results to NIST in electronic form, the values of W (not rounded to eight decimal places) in the electronic file were used in calculating the mean value given in the tables for a given fixed point. As a result, the mean values given in the tables may differ by about 0.01 mK from the values of the mean as calculated directly from the listed W values. The range of W values for each of the fixed points obtained by each of the participants is given also in the tables in equivalent temperature. These ranges of W

values for participants and SPRTs are shown in Figures 8 through 15 for Al, Zn, Cd, Sn, In, Ga, Hg and Ar, respectively. The uncertainty budgets, as reported by the participants and that lead to the expanded uncertainty values in the results, are given in Appendix IV.

In Table 6 through 20 we give the mean W values, their combined uncertainties, u_c ($k = 1$), the degrees of freedom (*DF*), and the differences and their uncertainties between the mean W values, expressed as the equivalent temperatures, from the realizations by each of the participants and those of the other 14 participants. The uncertainties were calculated as described in Section 5.3. Except for the case of NRLM, measurements were made by NIST on each of the SPRTs circulated among the participants. The furnace-cell arrangement at NRLM precluded their use of the NIST SPRT sent to them; their system requires an exceptionally long SPRT. Fortunately, NML was able to obtain an SPRT that met NRLM's requirements. NIST did not make measurements on that SPRT. Consequently, the uncertainties in the differences between NRLM and the participants other than NML may be larger than would otherwise be the case since the results of an additional intermediate laboratory is involved in computing those differences.

The pair-wise temperature differences and their associated uncertainties given in Tables 6 through 20 and shown in Figures 16 through 23 were calculated for the various laboratories by two paths. Those paths are indicated by the terms 'direct' and 'inclusive' and yield results that are indicated in the tables and figures by the same terms. In some cases, the paths are identical.

The 'direct' differences are the temperature differences between the realizations of a pair of laboratories that were obtained using the shortest available path linking those laboratories. In some cases, this means that the laboratories are compared using measurements made on the same SPRT or SPRTs. Where necessary, however, NIST or NML serves as an intermediary, linking the measurements of the two laboratories.

In some cases, of course, direct differences may not use all of the data reported by one or the other of the laboratories of the pair or of the intermediate laboratory (if any). This situation often arises in cases in which both laboratories of the pair made measurements on one SPRT but in which one or both members also made measurements on another SPRT not measured by the other laboratory. Examples of this case are provided by the temperature differences between SMU and BNM-INM, VNIIM and NPL, SMU and VNIIM, VNIIM and BNM-INM, and NPL and BNM-INM. In other cases, however, as can be seen from Tables 6 through 20, the direct differences do use all of the reported data of the two laboratories of the pair. For example, differences such as those between SMU and NPL use all of the date reported by both laboratories.

The 'inclusive' differences are those in which all of the data obtained by the pair of laboratories involved are used in the calculations of their pair-wise temperature differences and their associated uncertainties. In inclusive differences, whether or not there is a direct linkage between the laboratories, NIST and possibly also NML may be used as intermediaries so that the temperature differences can be computed using all relevant data. NIST was selected as the intermediate laboratory for these differences because, overall, that results in a minimum number of intermediate laboratories in the pair-wise differences. If NML and PTB had been included as intermediate laboratories, the pair-wise differences would have been somewhat different but the uncertainties would have been only slightly different.

When pair-wise temperature differences obtained from calculations using the direct and inclusive paths are different, then one or the other path may provide the better precision. Because the direct differences use measurements only from the shortest path between the laboratories, they will tend to provide more precise estimates of the temperature differences when the uncertainties of the intermediate laboratories (when needed) are large relative to the uncertainties of the pair of laboratories. Due to the increased averaging of results across different SPRTs, inclusive differences will tend to be more precise in cases in which the intermediate laboratories have relatively low uncertainty.

Comparison of direct and inclusive differences also can provide further insight into the differences between laboratories. Direct differences can provide temperature differences as observed for a single SPRT. This can be useful as a check for interactions between particular thermometers and a laboratory's measurement procedures. Two laboratories may agree closely with one another when the results are averaged across different thermometers because one or both may have results that are systematically higher for some thermometers and systematically lower for others. Of course, this type of interaction between thermometers and measurement procedures can be detected only when one laboratory is compared with another using at least two SPRTs. This is observable in some of the pairs of direct and inclusive comparisons in this study. Significant interactions between thermometers and laboratories could arise from a variety of causes. Some possible causes include thermometer instability, inadequate immersion, particular measurement methods, measurement equipment, laboratory conditions, etc. In any specific case, however, the actual cause of an interaction can really only be determined by study of the underlying physics of the problem and further experimentation, the logical follow-ups to a key comparison.

As can be seen in Tables 4 and 5 for NML, PTB, BNM-INM, SMU, NPL and BIPM, comparison measurements were made in each of those laboratories with at least two SPRTs that were also used in measurements at NIST. As can further be seen from the data presented in those tables, the pertinent pair-wise differences in realizations in those laboratories, as obtained with the different SPRTs, sometimes differ from one another . Since the participants sent the results of their measurements on both SPRTs to NIST, we used the averages of the differences obtained with the different SPRTs in all subsequent calculations of pair-wise differences.

The pair-wise differences, and their uncertainties, between laboratories given in Tables 6 through 20 are summarized for each of the fixed points Al, Zn, Cd, Sn, In, Ga, Hg and Ar in Tables 21 through 28, respectively. The differences obtained with the different SPRTs are apparent in the bilateral differences given in these tables for the cases where the 'direct" and 'inclusive', as described above, are different.

Plots of the differences between the *W* values of any one of the various participants and all of the other participants for each of the fixed points Al, Zn, Cd, Sn, In, Ga, Hg and Ar are given in Figures 16 through 23. The uncertainty bars represent the expanded uncertainty interval that should capture the true temperature difference between any two laboratories with approximately 95% confidence (or more in a few cases, as described in the Section 5.3). The values of the differences are expressed as the equivalent temperature differences.

5.3 Data Analysis for Comparison of Fixed-Point Cells

This section describes the procedures used in the analysis of the data for key comparison 3 of the realizations of the ITS-90. As previously described, each laboratory participating in the key comparison provided resistance ratios, denoted W, measured in their own fixed-point cells with transfer thermometers provided by NIST (by NML in the case of NRLM) for some or all of the eight fixed points included in the comparison, i.e., for Al, Zn, Cd, Sn, In, Ga, Hg, and Ar. Some participants measured each fixed point in only a single freeze or melt, while others used multiple freezes or melts at each point. Similarly, some participants used only one transfer thermometer while others made measurements with two transfer thermometers. Uncertainties, computed from the comparison data directly, or based on additional measurements with the fixed-point cells and a check thermometer, were also provided by each participant (see Appendix IV).

Differences of mean resistance ratios for each fixed point were computed from the W values for a given transfer SPRT for every pair of laboratories making measurements with that SPRT and then converted into the equivalent temperature differences using values of $\mathrm{d}W_r/\mathrm{d}T$ where W_r is the relevant ITS-90 reference function. For each pair of laboratories using a common transfer thermometer, the temperature differences between the laboratories were computed directly. If a pair of laboratories each made measurements with a particular pair of transfer thermometers, then temperature differences were computed for each thermometer and the differences were averaged to obtain the overall difference between those laboratories.

In cases where two laboratories did not make measurements on the same transfer thermometer, the differences were computed through the coordinating laboratory (NIST). The only exception to this was for comparisons with NRLM. For additional information on the temperature differences computed, see Section 5.2.

The information provided as part of the uncertainty of the measurements at each fixed point by each participant included the repeatability, or standard uncertainty, of a single resistance ratio for multiple freezes or melts, denoted S_A, the number of freezes or melts reported for computation of mean temperature differences, denoted n, the degrees of freedom associated with S_A, denoted DF_A, and the standard uncertainties for any other sources of variation affecting the measurements. Some of the sources of uncertainty typically included, in addition to the resistance-ratio repeatability, were impurities in fixed-point cell composition, hydrostatic-head errors, SPRT self-heating errors, etc. The specific sources of uncertainty and associated uncertainty values can be found for each laboratory in Appendix IV. The combined uncertainty due to sources of variability other than resistance ratio repeatability were combined by root-sum-of-squares and are denoted by S_B

Generally, uncertainties were given in terms of temperature rather than in terms of W. Whenever uncertainty values were given in terms of ΔW, the values were converted into the equivalent temperatures using the values of $\mathrm{d}W_r/\mathrm{d}T$. All uncertainties given in this section are reported in terms of temperature and are given in mK.

Typically, the resistance-ratio repeatability, S_A, was obtained using Type A methods of evaluating uncertainty, thus giving rise to the notation being used. In some cases, the S_A was obtained from data of control charts for check thermometers, such as those given for NIST, as an example, in

Appendix V. In other cases, where control-chart data or degrees of freedom were not available, S_A was computed from the W values reported for the key comparison. If a laboratory reported S_A as the standard uncertainty of the mean of some number of measurements, S_A was converted to the standard uncertainty for a single freeze or melt using information provided by the laboratory describing their computation and reporting of S_A. It was occasionally the case that at one, or a few, of the fixed points, a participant evaluated resistance-ratio repeatability using Type B methods; these too are included in S_A despite the suggestion that S_A is an uncertainty term evaluated purely by Type A methods.

The other sources of uncertainty, summarized in the term S_B, were generally obtained using Type B methods. These sources of uncertainty are taken to be components of uncertainty that affect a set of measurements made with a specific fixed-point cell in a specific measurement system in the same way. That is, the effects of these sources of variability do not vary in any practical sense from freeze to freeze. As for S_A, the amount of uncertainty associated with a particular uncertainty source included in S_B was occasionally evaluated by Type A methods but is still summarized in S_B. All sources of uncertainty included in S_B were confirmed to be reported in terms of standard uncertainty before being summarized as the combined uncertainty S_B. In some cases, degrees of freedom were explicitly given for each source of uncertainty included in S_B. When this was done, the degrees of freedom associated with $\boldsymbol{S_B}$ were obtained by using the Welch-Satterthwaite formula as described in the ISO Guide to the Expression of Uncertainty in Measurement (1993, pp 61-65). If the degrees of freedom were not given explicitly for a particular component included in S_B, then that component of S_B was assumed to have an infinite number of degrees of freedom. The degrees of freedom associated with S_B are denoted by DF_B.

As mentioned in the previous section, uncertainties are reported in Tables 3, 4, and 5 for the mean resistance ratio, $\overline{W}$, obtained by each laboratory for each transfer thermometer. These values typically differ from the summary values reported by each laboratory (and given in Appendix IV) because the laboratories were not required to summarize their uncertainties for each thermometer in a standardized format. Therefore, when the uncertainties were summarized for inclusion in Tables 3, 4, and 5, they were all converted, as necessary, to a common format. In the format used in Tables 3, 4, and 5, the combined standard uncertainty of $\overline{W}$ for each thermometer is related to the final uncertainties calculated for the temperature differences between laboratories given in Tables 6 through 20. The relationship between the components of uncertainty reported by the laboratories and the combined standard uncertainty of $\overline{W}$, $u_c(\overline{W})$, expressed in mK, is given by

$$u_c(\overline{W}) = \sqrt{\frac{S_A^2}{n} + S_B^2}\,. \qquad (1)$$

We give some numerical examples to clarify the computations described in the paragraph above. First, consider the uncertainty for Al as measured with SPRT 4385 by NIST. The W values and $u_c(\overline{W})$ for this fixed-point are shown in Table 5 and the uncertainties reported by NIST are given in Table IV.8(a). NIST made four measurements of W(Al) with SPRT 4385 and reported values of $S_A = 0.28$ and $S_B = 0.16$. Inserting these into eq. (1) yields

$$u_\mathrm{c} = \sqrt{\frac{0.28^2}{4} + 0.16^2} = 0.21. \tag{2}$$

NIST's reported combined standard uncertainty in Table IV.8(a) does not take into account the number of W values measured with SPRT 4385 in this comparison and is given as $u_\mathrm{c} = 0.32$. For SPRT 1030, also shown in Table 5, NIST made five measurements. During the course of the comparison, however, NIST was informed by PTB that SPRT 1030 was involved in some unknown incident just before measurements at SMU and that the subsequent measurements should reflect this. This led to the division of the data into sets denoted by 1030A and 1030B. These data were treated as coming from two SPRTs. NIST made three measurements using SPRT 1030A and the value of $u_\mathrm{c}(\overline{W})$ was computed to be

$$u_\mathrm{c} = \sqrt{\frac{0.28^2}{3} + 0.16^2} = 0.23. \tag{3}$$

For SPRT 1030B, $u_\mathrm{c}(\overline{W}) = 0.25$ because $n = 2$.

One of the interesting features in the estimation of uncertainties for the temperature differences in this comparison arises from the fact that the degrees of freedom and the number of measurements used to compute the mean resistance ratio are not necessarily directly related. In most applications the same data used to estimate a mean quantity are also used to estimate the uncertainty. In this comparison, however, because check thermometers can be used to estimate the resistance-ratio repeatability of a measurement system and fixed-point cell, the degrees of freedom can be much greater than the number of measurements used in any particular comparison. For example, for SPRT 4385 NIST has $n = 4$ at the Al fixed-point but has $DF_\mathrm{A} = (130 - 1) = 129$, as shown in Tables 5 and IV.8(a).

In addition to the uncertainties reported by each laboratory for the data they collected for this key comparison, uncertainties for possible changes in each transfer thermometer over the course of the comparison were also computed and included for each temperature difference. This component of uncertainty was computed in response to discussion at the thermometry working meeting held at NIST in January 2000. Because they affect only differences in measurements made with the transfer thermometers over time, these SPRT uncertainty components are included only in the uncertainties of the temperature differences between laboratories, and not in the uncertainties of the measurements made in a single laboratory.

These additional uncertainties were computed by first computing the difference in W observed at NIST (or at NML for SPRT 040) at each fixed point, using data taken before each thermometer was sent out to the sub-coordinating laboratories and after its return. If there were no evidence of change in the before and after W values for the thermometer use at a particular fixed point, based on a t test, the additional uncertainty component for that fixed point was set to zero. If the t test indicated that a change was likely to have occurred, the absolute difference between the before and after W values was converted to a Type B uncertainty based on a uniform distribution by dividing the half-width of the interval defined by the before and after travel difference by $\sqrt{3}$. The degrees of freedom for this uncertainty were approximated using the methods described in Appendix E (equation G.3) of the ISO *Guide to the Expression of Uncertainty in Measurement.*

The formula for the t-test used to determine whether or not a change in the SPRT had occurred is

$$\frac{(\overline{W}_{\text{After}} - \overline{W}_{\text{Before}})}{\mathrm{d}W_{\text{r}} / \mathrm{d}T} \pm t(0.975, DF_{\text{A}}) S_{\text{A}} \sqrt{\frac{1}{n_{\text{After}}} + \frac{1}{n_{\text{Before}}}} \tag{4}$$

where

$\overline{W}_{\text{Before}}$ is the mean resistance ratio measured at NIST before the thermometer traveled to the sub-coordinating laboratory,

$\overline{W}_{\text{After}}$ is the mean resistance ratio measured at NIST after the thermometer returned from the sub-coordinating laboratory,

$t(0.975, DF_{\text{A}})$ is the 95% expansion factor from the t distribution for a two-sided interval and the degrees of freedom of NIST's freeze-to-freeze repeatability, S_{A},

n_{Before} is the number of measurements made at NIST before the thermometer traveled, and

n_{After} is the number of measurements made at NIST after the thermometer traveled.

As a numerical example to make the equations above easier to follow, if one inserts the numbers for SPRT 1098A for the Al fixed-point into eq. (4), it yields the following confidence interval:

$$\frac{(3.375747625 - 3.375746950)}{0.000003205} \pm (1.978524)(0.28)\sqrt{\frac{1}{1} + \frac{1}{3}} \tag{5}$$

which simplifies to

$$0.21 \text{ mK} \pm 0.64 \text{ mK}.$$

Since the expanded uncertainty (0.64 mK) is larger in absolute value than the observed difference (0.21 mK) between the temperatures measured before and after the thermometer traveled, we conclude that nothing happened that affected the thermometer during travel.

Whenever the confidence interval for the difference in SPRT response before and after the SPRT traveled indicated that a significant change occurred during travel, then an uncertainty term for the difference was calculated as shown below, according to formula (6) from the ISO *Guide to the Expression of Uncertainty in Measurement* (page 13 in the 1993 edition).

$$u_{\text{SPRT}} = \frac{\left|\overline{W}_{\text{After}} - \overline{W}_{\text{Before}}\right|}{2\sqrt{3}(\mathrm{d}W_{\text{r}} / \mathrm{d}T)} \tag{6}$$

The degrees of freedom for this uncertainty were obtained by using formula G.3 from the ISO *Guide to the Expression of Uncertainty in Measurement*, substituting an estimate of the standard deviation of the absolute value of the difference of two normal random variables and the absolute temperature difference into the general terms given in the equation listed in the ISO *Guide to the Expression of Uncertainty in Measurement.* This is equivalent to the use of u_{SPRT} and its uncertainty in the formula since the scaling factor, $2\sqrt{3}$, cancels out of formula G.3. The formula for the estimate of the variance of the absolute difference of two normal random variables, which is not intuitively easy to understand, was obtained from the *Handbook of the Normal Distribution* by Patel and Read (1982, pp 33-34) and works out to be

$$u^2\left(\frac{\left|\overline{W}_{\mathrm{After}}-\overline{W}_{\mathrm{Before}}\right|}{\mathrm{d}W_{\mathrm{r}}/\mathrm{d}T}\right)=\left(\frac{(\overline{W}_{\mathrm{After}}-\overline{W}_{\mathrm{Before}})}{\mathrm{d}W_{\mathrm{r}}/\mathrm{d}T}\right)^2+S_{\mathrm{A}}^2\left(\frac{1}{n_{\mathrm{After}}}+\frac{1}{n_{\mathrm{Before}}}\right)- \\ \left(S_{\mathrm{A}}\sqrt{2/\pi}\,exp\left\{\frac{-(\overline{W}_{\mathrm{After}}-\overline{W}_{\mathrm{Before}})^2}{2S_{\mathrm{A}}^2\,(\mathrm{d}W_{\mathrm{r}}/\mathrm{d}T)^2}\right\}- \right. \\ \left.\frac{(\overline{W}_{\mathrm{After}}-\overline{W}_{\mathrm{Before}})}{\mathrm{d}W_{\mathrm{r}}/\mathrm{d}T}\left(1-2\Phi\left(\frac{(\overline{W}_{\mathrm{After}}-\overline{W}_{\mathrm{Before}})}{S_{\mathrm{A}}\,(\mathrm{d}W_{\mathrm{r}}/\mathrm{d}T)}\right)\right)\right)^2 \tag{7}$$

where *M* is the cumulative distribution function of the standard normal distribution.

This complicated formula gives numerical answers for the degrees of freedom that are only slightly different than those that would be obtained by approximating the variance of the absolute temperature difference by

$$u^2\left(\frac{\left|\overline{W}_{\mathrm{After}}-\overline{W}_{\mathrm{Before}}\right|}{\mathrm{d}W_{\mathrm{r}}/\mathrm{d}T}\right)\approx S_{\mathrm{A}}^2\left(\frac{1}{n_{\mathrm{After}}}+\frac{1}{n_{\mathrm{Before}}}\right) \tag{8}$$

All of the results given in this report are based on the more complicated, theoretically correct formula, however, because the approximation slightly under-estimates the degrees of freedom. Using an under-estimate of the degrees of freedom could have a high cost in terms of total uncertainty if the degrees of freedom computed with formula G.3 are small (i.e. three or less) and u_{SPRT} is large relative to the other uncertainty components.

In the two cases in which the shipment of the transfer thermometers easily allowed, or necessitated, the treatment of each SPRT as two effectively-different thermometers, the estimation of the uncertainty for potential thermometer changes was computed separately for each effectively-different thermometer, if possible. Accordingly, SPRTs 1098A and 1098B have different uncertainties for potential thermometer changes during use. There were no intermediate measurements at NIST for SPRTs 1030A and 1030B, however, so the uncertainties for them are based on before and after measurements that include the change in SPRT 1030 leading to its treatment as two separate thermometers. As a result, the uncertainties given for SPRTs 1030A and 1030B are conservative estimates of u_{SPRT}.

The uncertainties quantifying potential changes in the transfer thermometers with use, and their associated degrees of freedom, are given in Table VI.2 in Appendix VI.

Focusing now on the computation of the temperature differences between laboratories and their uncertainties, derivation of the appropriate combined standard uncertainty from the formulas used to compute the temperature differences between laboratories yields the following results:

For a direct comparison between two laboratories using a single transfer thermometer

$$\Delta T_{\mathrm{Lab1-Lab2}} = \frac{\overline{W}_{\mathrm{Lab1}} - \overline{W}_{\mathrm{Lab2}}}{\mathrm{d}W_{\mathrm{r}} / \mathrm{d}T}, \tag{9}$$

which then leads to the uncertainty formula,

$$u_{\mathrm{c}}(\Delta T_{\mathrm{Lab1-Lab2}}) = \sqrt{\frac{S^2_{\mathrm{A_{Lab1}}}}{n_{\mathrm{Lab1}}} + S^2_{B_{Lab1}} + \frac{S^2_{\mathrm{A_{Lab2}}}}{n_{\mathrm{Lab2}}} + S^2_{\mathrm{B_{Lab2}}} + u^2_{\mathrm{SPRT}}}\ . \tag{10}$$

In the formula for the uncertainty of a direct comparison between laboratories with a single transfer thermometer, multiple freezes reduce the uncertainty in resistance-ratio repeatability, but not the uncertainty from the sources that are summarized in S_{B}. This is because all of the resistance ratios are affected by those sources of uncertainty in exactly the same, unknown way. The term $\mathrm{d}W_{\mathrm{r}}/\mathrm{d}T$ does not appear in the uncertainty formula because the conversion to temperature units is implicit in the definition of S_{A} and S_{B}.

For a direct comparison between two laboratories using two transfer thermometers

$$\Delta T_{\mathrm{Lab1-Lab2}} = \frac{\frac{1}{2}(\overline{W}_{\mathrm{Lab1,SPRT1}} - \overline{W}_{\mathrm{Lab2,SPRT1}}) + \frac{1}{2}(\overline{W}_{\mathrm{Lab1,SPRT2}} - \overline{W}_{\mathrm{Lab2,SPRT2}})}{\mathrm{d}W_{\mathrm{r}} / \mathrm{d}T}, \tag{11}$$

which yields the uncertainty formula,

$$u_{\mathrm{c}}(\Delta T_{\mathrm{Lab1-Lab2}}) = \sqrt{\frac{S^2_{\mathrm{A_{Lab1}}}}{4n_{\mathrm{Lab1,SPRT1}}} + \frac{S^2_{\mathrm{A_{Lab2}}}}{4n_{\mathrm{Lab2,SPRT1}}} + S^2_{\mathrm{B_{Lab1}}} + \frac{S^2_{\mathrm{A_{Lab1}}}}{4n_{\mathrm{Lab1,SPRT2}}} + \frac{S^2_{\mathrm{A_{Lab2}}}}{4n_{\mathrm{Lab2,SPRT2}}} + S^2_{\mathrm{B_{Lab2}}} + \frac{u^2_{\mathrm{SPRT1}}}{4} + \frac{u^2_{\mathrm{SPRT2}}}{4}} \tag{12}$$

In this uncertainty formula, as in the immediately preceding one, the averaging of data from multiple freezes reduces the amount of uncertainty arising from sources of random uncertainty. The averaging of temperature differences measured with different thermometers also reduces the amount of random uncertainty from potential changes in the SPRT over time but does not affect the amount of uncertainty from the sources summarized in S_B, which often tend to dominate the total uncertainty. Averaging the results from two thermometers for laboratories 1 and 2 is the source of the number 4 in the denominators of the S_A and u_{SPRT} terms.

For an indirect comparison of the temperature difference between two laboratories, with the exceptions noted above for NRLM,

$$\Delta T_{\text{Lab1-Lab2}} = (\Delta T_{\text{Lab1-NIST}} - \Delta T_{\text{Lab2-NIST}}), \tag{13}$$

which leads to the uncertainty

$$u_c(\Delta T_{\text{Lab1-Lab2}}) = \sqrt{u_c^2(\Delta T_{\text{Lab1-NIST}}) + u_c^2(\Delta T_{\text{NIST-Lab2}}) - 2S^2_{B_{\text{NIST}}}}\ . \tag{14}$$

In this uncertainty formula, the variances of the temperature differences between each laboratory and NIST are first combined and then adjusted so that the term S_B, which affects all of the measurements made using the NIST measurement system and fixed-point cells in the same, but unknown, way is not included in the uncertainty. This term can, and in fact should, be eliminated from this uncertainty because the effects from the sources of uncertainty in the NIST measurements included in $S_{B_{\text{NIST}}}$ cancel out in the indirect comparison computations.

The equations above for typical indirect comparisons could be used to describe the indirect comparisons between NRLM and the other laboratories whose measurements were coordinated by NML by substituting NML for NIST in the subscripts. For indirect comparisons between NRLM and laboratories whose measurements were coordinated by PTB or NIST, the temperature difference is computed by

$$\Delta T_{\text{Lab1-NRLM}} = (\Delta T_{\text{Lab1-NIST}} - \Delta T_{\text{NML-NIST}} - \Delta T_{\text{NRLM-NML}}) \tag{15}$$

which leads to the uncertainty

$$u_c(\Delta T_{\text{Lab1-NRLM}}) = \sqrt{u_c^2(\Delta T_{\text{Lab1-NIST}}) + u_c^2(\Delta T_{\text{NIST-NML}}) + u_c^2(\Delta T_{\text{NML-NRLM}}) - 2S^2_{B_{\text{NIST}}} - 2S^2_{B_{\text{NML}}}} \tag{16}$$

For all of the different types of temperature differences and uncertainties described above, expanded uncertainties were then computed by algebraically expanding the uncertainty estimates given above into independent terms, collecting the terms and finding the effective degrees of freedom for the uncertainty using the Welch-Satterthwaite formula (as cited above). The coverage factor, *k*, was taken to be the 97.5% percentile of the Student's t distribution with the effective degrees of freedom resulting from the Welch-Satterthwaite calculations. This yields an expanded uncertainty interval that should capture the true temperature difference between any two laboratories with approximately 95% confidence.

Using the effective degrees of freedom in the uncertainty calculations is important because the degrees of freedom account for the uncertainty in the uncertainty estimates, which can be appreciable in some cases. Because there was not an agreed upon number of measurements to be made by each participant in the comparison, there were sometimes wide variations in the number of measurements used to compute mean resistance ratios and uncertainties. Table VI.3 of Appendix VI shows the actual coverage probabilities obtained when $k = 2$ is used to compute expanded uncertainties and the data have different numbers of degrees of freedom. Expanded uncertainties based on $k = 2$ are often assumed to have confidence close to the nominal 95% level obtained when the degrees of freedom are large. As the numbers in Table VI.3 show, however, for low degrees of freedom the confidence level attained can be quite different from 95%. Analogous confidence levels are given also for combined uncertainties computed with $k = 1$. The combined uncertainties are subject also to the same variations in attained coverage when the degrees of freedom are low to moderate rather than obtaining the nominal coverage 68.3% generally associated with $k = 1$. Therefore, using standard uncertainties does not save us from accounting for the degrees of freedom used in each comparison.

As Table VI.3 shows, some of the expanded uncertainties in this comparison could be as low as 80% confidence intervals while others would be 95% intervals (or slightly higher) if a uniform expansion factor of k=2 was used instead of taking the degrees of freedom associated with each particular comparison into account. The values of k needed to obtain 95% coverage, listed in the right-hand column of the table, show the nonlinearity in the relationship between expansion factors and degrees of freedom for 95% confidence intervals.

The differences between nominal and actual coverage values for both the k=1 and k=2 intervals comes from the uncertainty in the uncertainty estimates themselves. Without having a fairly large amount of data to compute uncertainty estimates, they are subject to relatively large amounts of random error. Each uncertainty estimate is an unbiased estimate of the true uncertainty but will fluctuate a lot from one set of measurements to the next when based on few measurements. The amount of uncertainty in the uncertainty estimates is quantified by the degrees of freedom. High degrees of freedom indicate uncertainty estimates that are well known, or have small uncertainty, while low degrees of freedom indicate uncertainty estimates that are poorly known, or have large uncertainty.

Unfortunately, in a few cases the results obtained by computing the expanded uncertainties using the procedure described above were subject to paradoxical behavior relative to physical intuition. Due to the nature of statistical confidence intervals based on quantities distributed according to a Student's t distribution, it is possible for the expanded uncertainty from a direct comparison between two laboratories, say Lab 1 and NIST, to be larger than the expanded uncertainty of an indirect comparison between Lab 1 and Lab 2 that includes the direct comparison between the laboratories Lab 1 and NIST and Lab 2 and NIST. Confidence intervals computed using the Welch-Satterthwaite formula to approximate the degrees of freedom of the uncertainty are prone to this in particular, although not exclusively. This is considered by some, including some of the authors of this report, to be a limitation of these formulae. For example, the expanded uncertainty for a comparison between a laboratory, denoted Lab 1, and NIST of the form

$$\Delta T_{\text{Lab1-NIST}} = \frac{\overline{W}_{\text{Lab1}} - \overline{W}_{\text{NIST}}}{\mathrm{d}W_{\mathrm{r}} / \mathrm{d}T} \tag{17}$$

can be larger than the expanded uncertainty for a comparison of Lab 1 with another laboratory, Lab 2, in which the comparison is made through NIST and is of the form

$$\Delta T_{\mathrm{Lab1-Lab2}} = (\Delta T_{\mathrm{Lab1-NIST}} - \Delta T_{\mathrm{Lab2-NIST}}) . \tag{18}$$

It is important to note that this effect occurs only with expanded uncertainties. The standard uncertainties are ordered as physical intuition suggests they should be and are not affected by this phenomenon. This is because the confidence levels of these intervals with k=1 are not being held at fixed confidence levels that are specified in the analysis methods.

Surprisingly, the counter-intuitive phenomenon described in the previous two paragraphs is not a defect of statistical theory, although it seems so at first glance. This phenomenon occurs because of the effective "averaging out" or "balancing" of errors in the uncertainty estimates when multiple uncertainty estimates are combined. As the uncertainty of the aggregate uncertainty estimate drops, its degrees of freedom increase and the associated value of k needed to maintain 95% confidence also drops. In fact, when the degrees of freedom start at the low end of the scale, the coverage factor drops extremely quickly, sometimes faster than the uncertainty estimate itself increases. As the drop in the coverage factor occurs, however, the desired confidence level is maintained.

In any case, because of the situation described above, the majority of the authors of this report favored an alternative approach to the computation of expanded uncertainties. This alternative approach is used for all of the results given in this report and is described next.

In the alternative approach to the computation of expanded uncertainties that was chosen, the first two steps in the computation are essentially the same as the ISO method, the standard uncertainty for each type of comparison described above was algebraically expanded into independent terms in each uncertainty and the terms were collected. Then the effective degrees of freedom for all of the terms associated with each laboratory were computed using the Welch-Satterthwaite formula. Expanded uncertainties were computed for each laboratory's contribution to the total uncertainty using a coverage factor from the t distribution and the effective degrees of freedom. The effective degrees of freedom and coverage factor for each laboratory's uncertainty are given by the formulas

$$DF_{\mathrm{Lab}} = \frac{\left(\frac{S^2_{\mathrm{A_{Lab1}}}}{n_{\mathrm{Lab1}}} + S^2_{\mathrm{B_{Lab1}}} \right)^2}{\frac{S^4_{\mathrm{A_{Lab1}}}}{n^2_{\mathrm{Lab1}} DF_{\mathrm{A}}} + \frac{S^4_{\mathrm{B_{Lab1}}}}{DF_{\mathrm{B}}}} \tag{19}$$

and

$$k_{\mathrm{Lab}} = t_{0.975,\ DF_{\mathrm{Lab}}} . \tag{20}$$

Coverage factors for the uncertainty attributed to the use of each SPRT (denoted k_{SPRT}) were also computed as shown in Eq. (20) using the effective degrees of freedom found in Table VI.2 in

Appendix VI. Finally, these expanded uncertainties were combined by root-sum-of-squares to obtain the final expanded uncertainty.

For a direct comparison of the temperature at two laboratories of the type

$$\Delta T_{\mathrm{Lab1-Lab2}} = \frac{\overline{W}_{\mathrm{Lab1}} - \overline{W}_{\mathrm{Lab2}}}{\mathrm{d}W_{\mathrm{r}} / \mathrm{d}T} \tag{21}$$

in which each laboratory used the same transfer thermometer, this results in the following expanded uncertainty

$$U(\Delta T_{\mathrm{Lab1-Lab2}}) = \sqrt{k_{\mathrm{Lab1}}^2\left(\frac{S_{\mathrm{A_{Lab1}}}^2}{n_{\mathrm{Lab1}}} + S_{\mathrm{B_{Lab1}}}^2\right) + k_{\mathrm{Lab2}}^2\left(\frac{S_{\mathrm{A_{Lab2}}}^2}{n_{\mathrm{Lab2}}} + S_{\mathrm{B_{Lab2}}}^2\right) + k_{\mathrm{SPRT1}}^2 u_{SPRT1}^2} \tag{22}$$

For an indirect comparison of the temperature at two laboratories of the type

$$\Delta T_{\mathrm{Lab1-Lab2}} = (\Delta T_{\mathrm{Lab1-NIST}} - \Delta T_{\mathrm{Lab2-NIST}}) \tag{23}$$

in which each laboratory used a different transfer thermometer, this results in the following expanded uncertainty

$$U(\Delta T_{Lab1-Lab2}) = \sqrt{k_{\mathrm{Lab1}}^2\left(\frac{S_{A_{Lab1}}^2}{n_{\mathrm{Lab1}}} + S_{B_{Lab1}}^2\right) + k_{\mathrm{NIST}}^2\left(\frac{S_{\mathrm{A_{NIST}}}^2}{n_{\mathrm{NIST_1}}} + \frac{S_{\mathrm{A_{NIST}}}^2}{n_{\mathrm{NIST_2}}}\right) + k_{\mathrm{Lab2}}^2\left(\frac{S_{A_{Lab2}}^2}{n_{\mathrm{Lab2}}} + S_{B_{Lab2}}^2\right) + k_{\mathrm{SPRT1}}^2 u_{SPRT1}^2 + k_{\mathrm{SPRT2}}^2 u_{SPRT2}^2} \tag{24}$$

Note that in eq. (24), the coverage factor for NIST is based only on the random portion of the uncertainty, S_{A}, because that is the only portion of the uncertainty that affects the temperature difference in the cases in which NIST serves as an intermediary.

The expanded uncertainties for all of the other types of comparisons between laboratories described above were obtained analogously.

While the alternate method for computing expanded uncertainties used here is not in line with the methods described in the ISO *Guide to the Expression of Uncertainty in Measurement*, it always results in larger expanded uncertainty intervals than the ISO methods and is therefore more conservative than the procedures outlined there. When the degrees of freedom associated with each of the components of uncertainty in u_{c} are large, the alternative method will be only slightly conservative. When the degrees of freedom for one or more of the uncertainty components in u_{c} are low, however, it can become extremely conservative. Of course one of the primary advantages suggesting use of this alternate method is the fact that both the standard uncertainties and expanded uncertainties will be ordered according to physical intuition.

The results of the data analysis are given in the Tables 6 through 28 and Figures 16 through 23. The results reported include mean resistance ratios for each laboratory for each thermometer used in a particular comparison, the standard uncertainty of the mean resistance ratio (given in terms of temperature), and the effective degrees of freedom of the mean resistance ratio. The estimated temperature differences between the laboratories and the standard and expanded uncertainties of the temperature differences are given also. Please note that the description of the data analysis given above provides the general procedures followed for each comparison. In some cases, the data for a particular comparison had to be handled slightly differently than the general case described above.

5.4. Results of Direct and Indirect Comparisons of Ga Cells

As stated in Section 3, a Ga transfer cell was included among the devices sent to each participant to ascertain how closely the temperatures of all the participating laboratories' Ga cells agreed among themselves, as determined by "direct" or, in some cases, by "indirect" comparisons with the transfer cell. The results are presented in Tables 29a and 29b, respectively, and displayed in graphical form in Figure 24. These temperature differences obtained by direct or indirect comparisons of the cells may be compared with the bilateral temperature differences, also given in Tables 29a and 29b, obtained from the realizations of the Ga melting point as indicated by the calibrations of the circulating SPRTs.

The data analysis for the direct and indirect comparisons of the Ga cells was handled similarly to the analysis of the ITS-90 realizations. For the direct comparisons, those in which the two cells were measured simultaneously in nearly identical furnaces, paired differences of the W values, converted to terms of temperature, were averaged to determine the differences between the cells. The paired differences were used also to determine the repeatability of the measurements since the paired results should be less variable than non-paired results. The other sources of uncertainty included in the direct comparisons included hydrostatic head effects, SPRT self-heating effects, immersion effects, and effects arising from the choice of plateau values. All other sources of uncertainty reported by the participants will not affect the direct comparisons because each will affect the results in the same way and will therefore cancel.

For indirect comparisons, those in which the cells were compared sequentially in the same furnace rather than simultaneously, the mean W values were computed for each cell and then the difference of the means, expressed in terms of temperature, was used to determine the difference between the cells. When more than one thermometer was used, the results were averaged to get the best possible estimate of the difference between the cells. The sources of uncertainty included when assessing the variability of these mean temperature differences included all sources reported by the laboratories except for effects due to impurities in the cells. For the indirect comparisons, the values of measurement repeatability reported by the participants were used, rather than the values computed from the comparison data. This was done because the participant-reported-measurement-repeatability values were often based on more degrees of freedom and over a wider range of environmental conditions than the repeatability estimates from the comparison data alone.

For both types of comparisons, the number of freezes used to compute the mean differences in the cells was used in the uncertainty calculations. Also, as in the comparison of the ITS-90 realizations, expanded uncertainties for the differences between fixed-point cells were obtained for each laboratory's contribution to the comparison and then those expanded uncertainties were combined by root-sum-of-squares. The same method for obtaining expanded uncertainties as described in Section 5.3 applies to the analysis when used for direct or indirect comparison of fixed-point cells.

5.5. Results of Direct and Indirect Comparisons of Cd Cells

A Cd transfer cell was included also among the devices sent to each participant to ascertain how closely the temperatures of all the participating laboratories' Cd cells agreed among themselves, as determined by "direct" or, in some cases, by "indirect" comparisons with the transfer cell. The results are presented in Table 30a and Table 30b, respectively, and displayed in graphical form in Figure 25. These temperature differences obtained by direct or indirect comparisons of the cells may be compared with the bilateral temperature differences, also given in Tables 30a and 30b, obtained from the realizations of the Cd freezing point as indicated by the calibrations of the circulating SPRTs.

The data analysis methods used for the comparison of Cd fixed point cells is exactly analogous to the methods used for comparison of Ga cells. For a description of the methods used please refer to the discussion in Section 5.4.

6. DISCUSSION

The best method to compare the temperatures of fixed-point cells is by a direct, i.e., simultaneous, comparison of the cells, with the cells located in nearly identical furnaces and with measurements made on the samples at the same liquid/solid ratio. This method eliminates most systematic errors.

The best method for comparison of laboratories is to compare not only the temperatures of fixed-point cells by a direct comparison, but also to compare realizations of those fixed points through the calibrations of one or more SPRTs at those points in the respective laboratories, since the latter includes most systematic errors present in the measurements made in each of the laboratories. This, however, is not a practical method for key comparisons because of the amount of time and the cost that would be involved.

Considering the points made above, the types of comparisons utilized in this CCT key comparison appear to be a good compromise. In fact, it is believed that key comparison 3 represents the best global comparison to date of realizations of the ITS-90 over the temperature range of the comparison.

It was expected that the agreement among the laboratories of the Ga fixed-point temperature would be to within 0.02 mK to 0.05 mK, and certainly no worse than 0.05 mK. As can be seen from the results of the direct and indirect comparisons presented in Table 29a and Table 29b, respectively, however, the results are disappointing and obviously did not meet expectations. It is surprising that the results are in such poor agreement.

It appears that some, or most, of those participants not using bushings with the Rosemount transfer SPRTs may not have waited a sufficient length of time for the SPRTs to come into equilibrium with the inner liquid/solid interface of the sample. If that were the case, then the measured W values may not accurately reflect the true values for the respective fixed points.

The participants were asked to provide immersion curves, determined from data obtained at two measuring currents at each SPRT position in the cell (and obtained *during insertion* of the SPRTs into the cell) in order to determine the values at zero power dissipation. Some participants did not obtain immersion curves for some or all of the fixed points and some used only one current for the measurements. Consequently, those participants obtained comparison data that may have been obtained when the SPRT was not in equilibrium with the liquid-solid interface of the sample (and perhaps would have been influenced by variations of several kelvins in the temperature of the furnace), or when it was not clear if an inner liquid-solid interface had been formed along the full length of the sample. If the measurement techniques led to either of these conditions, then erroneous values of varying magnitude would have been obtained.

The Cd freezing-point temperature is a good secondary fixed point that can be used as a check point to evaluate the quality of calibrations of SPRTs from 0 °C through either 419.527 °C, 660.323 °C or 961.78 °C. As can be seen from the results of the direct and indirect comparisons, presented in Table 30a and Table 30b, respectively, and from the differences of those with those from realizations also presented in Table 30a and Table 30b, the agreement of the temperatures of the participants' cells was rather poor. Unfortunately, it was discovered that only seven participants had Cd fixed-point cells of their own so we decided not to address the non-uniqueness issue in the report since so many of the participants had little or no experience in using the Cd cell and consequently had no estimate of the uncertainty in the realization of its freezing point.

It was decided that key comparison reference values would not be given for this report. The NIST correspondence given in Appendix VII states the course of action on which the participants of key comparison 3 agreed. A tabulation of votes by the participants for and against key comparison reference values is given in Appendix VII. Additionally, the comments from the participating laboratories concerning key comparison reference values for this comparison are given also in Appendix VII. Although a minority of participants (5) thought that key comparison reference values should be used, they withdrew their objections in order for the report to be completed.

Table 1. NIST direct comparison of the gallium cells.

	Ga 961	Ga 94–3	
before PTB	W(Ga)	W(Ga)	ΔT, mK
1	1.118 137 63	1.118 137 67	-0.01_1
2	1.118 137 62	1.118 137 65	-0.00_8
3	1.118 137 64	1.118 137 67	-0.00_7
after repair			
4	1.118 137 63	1.118 137 65	-0.00_6
5	1.118 137 62	1.118 137 67	-0.01_1
6	1.118 137 63	1.118 137 66	-0.00_7
after PTB			
7	1.118 137 63	1.118 137 66	-0.00_8
8	1.118 137 62	1.118 137 66	-0.01_0
9	1.118 137 64	1.118 137 66	-0.00_6

	Ga 962	Ga 94–3	
before NML	W(Ga)	W(Ga)	ΔT, mK
1	1.118 137 59	1.118 137 65	-0.01_6
2	1.118 137 56	1.118 137 66	-0.02_4
3	1.118 137 60	1.118 137 66	-0.01_4
after NML			
4	1.118 137 57	1.118 137 66	-0.02_3
5	1.118 137 56	1.118 137 64	-0.02_0
6	1.118 137 58	1.118 137 67	-0.02_1

	Ga 965	Ga 94–3	
before VSL	W(Ga)	W(Ga)	ΔT, mK
1	1.118 137 63	1.118 137 68	-0.01_2
2	1.118 137 64	1.118 137 67	-0.00_9
3	1.118 137 61	1.118 137 67	-0.01_5
after VSL			
4	1.118 137 66	1.118 137 70	-0.01_1
5	1.118 137 65	1.118 137 66	-0.00_1
6	1.118 137 65	1.118 137 68	-0.00_7
after NRC			
7	1.118 137 63	1.118 137 67	-0.01_0
8	1.118 137 63	1.118 137 67	-0.01_2
9	1.118 137 62	1.118 137 67	-0.01_3
after IMGC			
10	1.118 137 66	1.118 137 67	-0.00_2
11	1.118 137 68	1.118 137 66	0.00_4
12	1.118 137 66	1.118 137 68	-0.00_6

Table 2. NIST direct comparison of the cadmium cells.

	Cd 96-1	**Cd 78-2**	
before PTB	W(Cd)	W(Cd)	ΔT, mK
1	2.218 819 92	2.218 818 42	0.42
2	2.218 819 83	2.218 818 57	0.35
3	2.218 820 03	2.218 818 63	0.39
after repair	Cd 96-1	Cd 96-3	
4	2.218 819 79	2.218 819 90	-0.03
5	2.218 819 70	2.218 819 88	-0.04
6	2.218 819 90	2.218 820 02	-0.03
after NRC	Cd 96-1	Cd 96-3	
7	2.218 819 58	2.218 819 72	-0.03
8	2.218 819 64	2.218 819 76	-0.03
9	2.218 819 62	2.218 819 94	-0.08
after IMGC	Cd 96-1	Cd 96-3	
10	2.218 819 66	2.218 819 79	-0.03
11	2.218 819 53	2.218 819 62	-0.02
12	2.218 819 75	2.218 819 75	0.00

	Cd 96-2	**Cd 78-2**	
before NML	W(Cd)	W(Cd)	ΔT, mK
1	2.218 819 79	2.218 818 54	0.32
2	2.218 819 70	2.218 818 36	0.34
3	2.218 819 90	2.218 818 65	0.32
after NML	**Cd 96-2**	**Cd 96-3**	
4	2.218 819 59	2.218 819 73	-0.03
5	2.218 819 68	2.218 819 95	-0.07
6	2.218 819 30	2.218 819 45	-0.04

	Cd 96-3	**Cd 78-2**	
	W(Cd)	W(Cd)	ΔT, mK
1	2.218 819 49	2.218 817 99	0.38
2	2.218 819 65	2.218 818 07	0.40
3	2.218 819 88	2.218 818 31	0.40

Table 2. cont'd. NIST direct comparison of the cadmium cells.

	Cd 96-4	**Cd 78-2**	
before PTB	W(Cd)	W(Cd)	ΔT, mK
1	2.218 819 81	2.218 818 58	0.31
2	2.218 820 07	2.218 818 70	0.35
3	2.218 819 69	2.218 818 39	0.33
after PTB	**Cd 96-4**	**Cd 96-3**	
4	2.218 818 67	2.218 818 63	0.01
5	2.218 818 77	2.218 818 83	-0.02
6	2.218 818 95	2.218 819 04	-0.02
	Cd 96-5	**Cd 78-2**	
before VSL	W(Cd)	W(Cd)	ΔT, mK
1	2.218 819 69	2.218 818 32	0.35
2	2.218 820 04	2.218 818 45	0.40
3	2.218 819 86	2.218 818 37	0.38
	Cd 96-5	**Cd 96-3**	
after repair	W(Cd)	W(Cd)	ΔT, mK
1	2.218 819 53	2.218 819 62	-0.02
2	2.218 819 73	2.218 819 82	-0.02
3	2.218 819 32	2.218 819 59	-0.07
	Cd 96-5	**Cd 96-3**	
4	2.218 819 93	2.218 820 18	-0.06
5	2.218 819 87	2.218 819 86	0.00
6	2.218 819 97	2.218 820 03	-0.02

Table 3. $W(T_{90})$ values, their range and the uncertainty of measurements at the fixed points.

Hart Model 5681, s/n 1094

All $W(T_{90})$ values in the order of measurement

	NIST #1, 8/97	NIST #2, 8/97	NIST #3, 9/97	VSL	NIST #4, 2/98
Al	3.375 732 03	3.375 732 15	3.375 732 70	3.375 731 25	3.375 733 35
Zn	2.568 746 80	2.568 747 33	2.568 747 64	2.568 746 43	2.568 748 30
Cd	2.219 018 81	2.219 019 13	2.219 019 60	2.219 015 43	2.219 020 60
Sn	1.892 711 91	1.892 712 02	1.892 712 28	1.892 710 70	1.892 712 95
In	1.609 746 04	1.609 746 34	1.609 746 27	1.609 741 78	1.609 746 97
Ga	1.118 129 75	1.118 129 79	1.118 129 79	1.118 128 87	1.118 129 72
Hg	0.844 151 41	0.844 151 53	0.844 151 45	0.844 151 64	0.844 151 48
Ar	0.215 910 58	0.215 910 65	0.215 910 56	0.215 910 32	0.215 910 53

$W(T_{90})$ average, range and uncertainty for each laboratory

	NIST			**VSL**		
	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK
Al	3.375 732 56	0.41	0.21	3.375 731 25		0.77
Zn	2.568 747 52	0.43	0.13	2.568 746 43		0.48
Cd	2.219 019 53	0.50	0.07	2.219 015 43		
Sn	1.892 712 29	0.28	0.06	1.892 710 70		0.37
In	1.609 746 41	0.25	0.04	1.609 741 78		0.33
Ga	1.118 129 76	0.02	0.01	1.118 128 87		0.21
Hg	0.844 151 47	0.03	0.04	0.844 151 64		0.20
Ar	0.215 910 58	0.03	0.03	0.215 910 32		0.33

Table 3. Cont'd.

Hart Model 5681, s/n 1098

All $W(T_{90})$ values in the order of measurement

	NIST #1, 1/97	NIST #2, 2/97	NIST #3, 2/97	NRC	NIST #4, 8/98	IMGC #1	IMGC #2	IMGC #3	NIST #5, 3/99
Al	3.375 746 19	3.375 746 98	3.375 747 68	3.375 753 30	3.375 747 63	3.375 735 28	3.375 744 16	3.375 740 54	3.375 747 50
Zn	2.568 756 95	2.568 758 13	2.568 757 89	2.568 754 00	2.568 759 17	2.568 754 54			2.568 759 03
Cd	2.219 023 10	2.219 023 90	2.219 022 99	2.219 020 11	2.219 024 19	2.219 019 11			2.219 024 60
Sn	1.892 712 87	1.892 712 27	1.892 712 31	1.892 707 68	1.892 713 29	1.892 713 07			1.892 713 81
In	1.609 745 10	1.609 744 90	1.609 744 80	1.609 741 25	1.609 745 89	1.609 744 75			1.609 745 58
Ga	1.118 128 40	1.118 128 27	1.118 128 14	1.118 127 72	1.118 128 27	1.118 128 69			1.118 128 42
Hg	0.844 151 69	0.844 151 50	0.844 151 61	0.844 152 46	0.844 151 54	0.844 151 19			0.844 151 52
Ar	0.215 909 39	0.215 909 07	0.215 909 00	0.215 909 68	0.215 909 44	0.215 912 46			0.215 909 13

$W(T_{90})$ average, range and uncertainty for each laboratory

	NIST (1098A) #1, #2, #3, & #4			NRC (1098A)			NIST (1098B) #4, #5			IMGC (1098B)		
	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK
Al	3.375 747 12	0.47	0.21	3.375 753 30		0.53	3.375 747 56	0.04	0.25	3.375 739 99	2.77	0.49
Zn	2.568 758 04	0.63	0.13	2.568 754 00		0.14	2.568 759 10	0.04	0.16	2.568 754 54		0.42
Cd	2.219 023 55	0.33	0.07	2.219 020 11		0.19	2.219 024 40	0.11	0.09	2.219 019 11		0.32
Sn	1.892 712 69	0.28	0.06	1.892 707 68		0.38	1.892 713 55	0.14	0.09	1.892 713 07		0.21
In	1.609 745 17	0.29	0.04	1.609 741 25		0.13	1.609 745 74	0.08	0.04	1.609 744 75		0.31
Ga	1.118 128 27	0.06	0.01	1.118 127 72		0.12	1.118 128 35	0.04	0.02	1.118 128 69		0.06
Hg	0.844 151 59	0.05	0.04	0.844 152 46		0.08	0.844 151 53	0.01	0.05	0.844 151 19		0.13
Ar	0.215 909 22	0.10	0.03	0.215 909 68		0.15	0.215 909 28	0.07	0.04	0.215 912 46		0.23

Table 4. $W(T_{90})$ values, their range and the uncertainty of measurements at the fixed points.

Rosemount Model 162CE, s/n 4386

All $W(T_{90})$ values in the order of measurement

	NIST #1, 1/97	NIST #2, 2/97	NIST #3, 2/97	NML #1	NML #2	NML#3	KRISS	NML#4
Al	3.375 674 38	3.375 674 16	3.375 674 65		3.375 665 32	3.375 673 23	3.375 661 60	3.375 674 80
Zn	2.568 703 45	2.568 703 06	2.568 703 98	2.568 701 27	2.568 699 76	2.568 700 44	2.568 700 00	2.568 700 98
Cd	2.218 979 40	2.218 981 16	2.218 980 96	2.218 972 84	2.218 973 22	2.218 973 75		2.218 976 84
Sn	1.892 680 84	1.892 681 47	1.892 681 47	1.892 674 25	1.892 674 88	1.892 675 90	1.892 679 30	1.892 677 75
In	1.609 724 15	1.609 724 84	1.609 724 47	1.609 715 11	1.609 715 38	1.609 715 23	1.609 729 50	1.609 716 43
Ga	1.118 124 76	1.118 124 60	1.118 124 48	1.118 122 54	1.118 121 45	1.118 125 02	1.118 124 60	1.118 123 81
Hg	0.844 159 34	0.844 159 36	0.844 159 01	0.844 158 68	0.844 158 19	0.844 157 86	0.844 161 30	0.844 158 00
Ar	0.215 953 58	0.215 953 35	0.215 953 45		0.215 938 75	0.215 940 56		0.215 941 52

	NIM#1	NIM#2	NML#5	NIST #4, 3/99
Al	3.375 663 94	3.375 663 90	3.375 671 70	3.375 673 01
Zn	2.568 704 97	2.568 704 61	2.568 703 98	2.568 704 04
Cd	2.218 984 63	2.218 985 55	2.218 977 92	2.218 980 36
Sn	1.892 676 44	1.892 677 31	1.892 677 67	1.892 681 22
In	1.609 718 49	1.609 718 16	1.609 718 15	1.609 724 31
Ga	1.118 121 85	1.118 122 71	1.118 124 46	1.118 124 63
Hg	0.844 160 00	0.844 160 25	0.844 157 97	0.844 159 45
Ar	0.215 952 54		0.215 946 59	0.215 953 87

$W(T_{90})$ average, range and uncertainty for each laboratory

	NIST			NML			KRISS			NIM		
	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK
Al	3.375 674 05	0.51	0.21	3.375 671 26	2.96	0.43	3.375 661 60		1.11	3.375 663 92	0.01	1.39
Zn	2.568 703 63	0.28	0.13	2.568 701 29	1.21	0.21	2.568 700 00		0.63	2.568 704 79	0.10	0.56
Cd	2.218 980 47	0.49	0.07	2.218 974 91	1.41	0.18				2.218 985 09	0.26	0.86
Sn	1.892 681 25	0.17	0.06	1.892 676 09	0.94	0.15	1.892 679 30		0.46	1.892 676 88	0.23	1.59
In	1.609 724 44	0.18	0.04	1.609 716 06	0.80	0.41	1.609 729 50		0.38	1.609 718 33	0.09	0.46
Ga	1.118 124 62	0.07	0.01	1.118 123 46	0.90	0.13	1.118 124 60		0.20	1.118 122 28	0.22	0.28
Hg	0.844 159 29	0.11	0.04	0.844 158 14	0.20	0.13	0.844 161 30		0.21	0.844 160 13	0.06	0.23
Ar	0.215 953 56	0.12	0.03	0.215 941 86	1.81	0.49				0.215 952 54		0.28

Table 4. Cont'd.

Hart Model 5681, s/n 1032

All $W(T_{90})$ values in the order of measurement

	NIST #1, 11/95	NIST #2, 2/96	NIST #3, 5/96	NML #1	MSL #1	MSL #2	NML #2	NIST #4, 3/99
Al	3.375 711 05	3.375 711 49	3.375 711 79					3.375 713 03
Zn	2.568 743 28	2.568 742 95	2.568 742 66	2.568 737 61	2.568 740 53		2.568 745 20	2.568 743 76
Cd	2.219 014 49	2.219 013 82	2.219 013 28	2.219 009 87			2.219 012 29	2.219 015 41
Sn	1.892 706 05	1.892 706 77	1.892 706 52	1.892 702 41	1.892 703 74		1.892 704 73	1.892 708 09
In	1.609 741 25	1.609 740 67	1.609 741 12	1.609 736 35	1.609 739 76		1.609 737 95	1.609 742 13
Ga	1.118 127 38	1.118 127 51	1.118 127 40	1.118 126 88	1.118 128 22	1.118 128 31	1.118 128 05	1.118 128 09
Hg	0.844 151 43	0.844 151 65	0.844 151 79	0.844 152 43	0.844 152 71			0.844 151 73
Ar	0.215 914 04	0.215 913 87	0.215 913 86				0.215 904 58	0.215 913 73

$W(T_{90})$ average, range and uncertainty for each laboratory

	NIST			NML			MSL		
	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK
Al	3.375 711 84	0.62	0.21						
Zn	2.568 743 16	0.32	0.13	2.568 741 40	2.17	0.24	2.568 740 53		1.01
Cd	2.219 014 25	0.59	0.07	2.219 011 08	0.67	0.20			
Sn	1.892 706 86	0.55	0.06	1.892 703 57	0.62	0.16	1.892 703 74		0.47
In	1.609 741 29	0.38	0.04	1.609 737 15	0.42	0.42	1.609 739 76		0.39
Ga	1.118 127 59	0.18	0.01	1.118 127 46	0.30	0.13	1.118 128 26	0.02	0.18
Hg	0.844 151 65	0.09	0.04	0.844 152 43		0.13	0.844 152 71		0.19
Ar	0.215 913 88	0.07	0.03	0.215 904 58		0.49			

Table 4. Cont'd.

Isotech Model 670, s/n 040

All $W(T_{90})$ values in the order of measurement

	NML#1	NRLM #1	NRLM #2	NRLM #3	NRLM #4	NML#2
Al	3.375 573 70	3.375 574 08	3.375 579 99	3.375 578 79	3.375 581 59	3.375 588 49
Zn	2.568 650 82	2.568 648 27	2.568 647 57	2.568 646 79	2.568 647 13	2.568 657 00
Cd	2.218 937 42					2.218 941 34
Sn	1.892 649 78	1.892 650 62	1.892 651 18	1.892 651 18	1.892 649 80	1.892 652 08
In	1.609 700 06	1.609 702 67	1.609 702 17	1.609 701 25		1.609 699 09
Ga	1.118 120 90	1.118 120 08	1.118 120 11	1.118 119 99		1.118 120 87
Hg	0.844 161 78	0.844 161 52				0.844 161 73
Ar						

$W(T_{90})$ average, range and uncertainty for each laboratory

	NML			**NRLM**		
	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK
Al	3.375 581 10	4.61	0.50	3.375 578 61	2.34	0.95
Zn	2.568 653 91	1.77	0.24	2.568 647 44	0.42	0.88
Cd	2.218 939 38	1.09	0.20			
Sn	1.892 650 93	0.62	0.16	1.892 650 69	0.37	0.38
In	1.609 699 57	0.26	0.42	1.609 702 03	0.37	0.45
Ga	1.118 120 89	0.01	0.13	1.118 120 06	0.03	0.11
Hg	0.844 161 75	0.01	0.13	0.844 161 52		0.30
Ar						

Table 5. $W(T_{90})$ values, their range and the uncertainty of measurements at the fixed points.

Rosemount Model 162CE, s/n 4385

All $W(T_{90})$ values in the order of measurement

	NIST #1, 1/97	NIST #2, 2/97	NIST #3, 2/97	PTB #1	VNIIM #1	VNIIM #2	VNIIM #3	PTB #2
Al	3.375 679 08	3.375 679 11	3.375 678 42		3.375 678 92	3.375 677 98	3.375 677 70	3.375 692 1
Zn	2.568 710 05	2.568 710 15	2.568 709 59	2.568 714 8	2.568 710 93	2.568 710 61	2.568 709 06	2.568 715 4
Cd	2.218 986 40	2.218 986 79	2.218 987 22		2.218 989 32	2.218 988 74	2.218 987 56	
Sn	1.892 685 28	1.892 685 78	1.892 685 76	1.892 687 3	1.892 687 15	1.892 686 74	1.892 685 62	1.892 686 3
In	1.609 727 64	1.609 727 80	1.609 727 73	1.609 725 2	1.609 728 52	1.609 728 37	1.609 728 19	1.609 724 0
Ga	1.118 125 07	1.118 125 08	1.118 124 99	1.118 123 9	1.118 125 16	1.118 125 05	1.118 124 88	1.118 124 1
Hg	0.844 157 36	0.844 157 44	0.844 157 79	0.844 157 6				0.844 157 9
Ar	0.215 946 88	0.215 947 10	0.215 947 10	0.215 946 0				0.215 945 9

	BNM #1	BNM #2	BNM #3	PTB #3	SMU #1	SMU #2	SMU #3	PTB #4
Al	3.375 693 06	3.375 693 36	3.375 692 82	3.375 693 0	3.375 688 1	3.375 690 1	3.375 695 3	3.375 694 1
Zn	2.568 721 47	2.568 715 96	2.568 720 61	2.568 714 5	2.568 718 1	2.568 720 4	2.568 715 4	2.568 714 2
Cd								
Sn	1.892 686 25	1.892 685 06	1.892 685 22	1.892 687 3	1.892 687 0	1.892 687 8	1.892 687 0	1.892 686 0
In	1.609 723 66	1.609 724 95		1.609 724 0				1.609 723 0
Ga	1.118 123 70	1.118 123 47	1.118 123 77	1.118 124 0	1.118 124 4	1.118 124 6	1.118 124 1	1.118 124 5
Hg	0.844 156 18			0.844 158 7				0.844 157 2
Ar	0.215 947 01			0.215 946 4				0.215 944 8

	NPL #1	NPL #2	BIPM #1	BIPM #2	PTB #5	NIST #4, 3/99
Al					3.375 692 1	3.375 679 97
Zn	2.568 721 3	2.568 717 9			2.568 714 3	2.568 710 69
Cd						2.218 988 06
Sn	1.892 685 6	1.892 680 5			1.892 686 3	1.892 686 16
In	1.609 722 4	1.609 721 7			1.609 722 5	1.609 728 53
Ga	1.118 123 1		1.118 123 2	1.118 123 2	1.118 124 3	1.118 124 83
Hg	0.844 158 7	0.844 158 2			0.844 157 6	0.844 157 65
Ar	0.215 942 4	0.215 944 0			0.215 946 0	0.215 947 27

Table 5. Cont'd.

$W(T_{90})$ average, range and uncertainty for each laboratory for **Rosemount Model 162CE, s/n 4385**

	NIST			PTB			VNIIM			BNM		
	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK
Al	3.375 679 15	0.48	0.21	3.375 692 83	0.62	0.84	3.375 678 20	0.38	0.54	3.375 693 08	0.17	1.12
Zn	2.568 710 12	0.31	0.13	2.568 714 64	0.34	0.64	2.568 710 20	0.54	0.54	2.568 719 35	1.58	0.52
Cd	2.218 987 11	0.46	0.07				2.218 988 54	0.49	0.53			
Sn	1.892 685 74	0.24	0.06	1.892 686 64	0.35	0.44	1.892 686 50	0.41	0.28	1.892 685 51	0.32	0.48
In	1.609 727 92	0.24	0.04	1.609 723 74	0.71	0.57	1.609 728 36	0.09	0.29	1.609 724 31	0.34	0.32
Ga	1.118 124 99	0.06	0.01	1.118 124 16	0.15	0.12	1.118 125 03	0.07	0.08	1.118 123 65	0.08	0.15
Hg	0.844 157 56	0.11	0.04	0.844 157 80	0.37	0.14				0.844 156 18		0.29
Ar	0.215 947 09	0.09	0.03	0.215 945 82	0.37	0.28				0.215 947 01		0.31

	SMU			NPL			BIPM		
	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK
Al	3.375 691 17	2.25	0.47						
Zn	2.568 717 97	1.43	0.41	2.568 719 60	0.97	0.44			
Cd									
Sn	1.892 687 27	0.22	0.45	1.892 683 05	1.37	0.36			
In				1.609 722 05	0.18	0.34			
Ga	1.118 124 37	0.13	0.10	1.118 123 10		0.22	1.118 123 20	0.00	0.08
Hg				0.844 158 45	0.12	0.20			
Ar				0.215 943 20	0.37	0.36			

Table 5. Cont'd.

Hart Model 5681, s/n 1030

All $W(T_{90})$ values in the order of measurement

	NIST #1, 12/95	NIST #2, 2/96	NIST #3, 6/96	PTB #2	BNM #1	BNM #2	BNM #3	BNM #4
Al	3.375 760 92	3.375 761 54	3.375 762 04	3.375 761 2	3.375 762 42	3.375 762 67		
Zn	2.568 771 26	2.568 771 02	2.568 771 82	2.568 760 3	2.568 764 11	2.568 760 05	2.568 761 96	
Cd	2.219 031 06	2.219 031 88	2.219 032 09					
Sn	1.892 715 87	1.892 716 01	1.892 716 20	1.892 714 9	1.892 714 27	1.892 712 54	1.892 710 81	
In	1.609 745 54	1.609 746 23	1.609 745 95	1.609 746 2	1.609 744 11	1.609 745 32		
Ga	1.118 127 80	1.118 127 70	1.118 127 65	1.118 128 6	1.118 129 03	1.118 128 54	1.118 129 02	1.118 128 80
Hg	0.844 150 80	0.844 151 08	0.844 151 19	0.844 150 9	0.844 149 44			
Ar	0.215 908 45	0.215 908 20	0.215 908 52	0.215 907 8	0.215 905 47			

	PTB #3	SMU #1	SMU #2	SMU #3	PTB #4	NPL #1	NPL #2	NPL #3
Al	3.375 760 3	3.375 757 5	3.375 753 1	3.375 767 8	3.375 761 3			
Zn	2.568 764 2	2.568 761 4	2.568 761 3	2.568 762 7	2.568 765 0	2.568 762 0	2.568 763 0	
Cd								
Sn	1.892 715 2	1.892 712 0	1.892 716 7	1.892 715 5	1.892 717 4	1.892 718 0	1.892 716 5	1.892 719 3
In	1.609 745 2				1.609 746 8	1.609 747 8	1.609 747 6	
Ga	1.118 128 8	1.118 128 7	1.118 128 6	1.118 128 7	1.118 129 6	1.118 128 3		
Hg	0.844 151 8				0.844 151 6	0.844 151 5	0.844 150 8	
Ar	0.215 908 1				0.215 905 7	0.215 902 3	0.215 903 9	0.215 903 5

	BIPM #1	BIPM #2	PTB #5	NIST #4, 2/99	NIST #5, 8/99
Al			3.375 761 1	3.375 764 64	3.375 763 66
Zn			2.568 764 2	2.568 773 36	2.568 772 59
Cd				2.219 033 55	2.219 032 81
Sn			1.892 718 8	1.892 717 37	1.892 717 10
In			1.609 747 5	1.609 747 02	1.609 747 04
Ga	1.118 128 8	1.118 128 8	1.118 129 7	1.118 127 72	1.118 127 72
Hg			0.844 149 9	0.844 151 23	0.844 151 15
Ar			0.215 907 6	0.215 908 17	0.215 908 02

Table 5. Cont'd.

$W(T_{90})$ average, range and uncertainty for each laboratory for **Hart Model 5681, s/n 1030**

	NIST (1030A)			**NIST (1030B)**			**PTB (1030A)**			**PTB (1030B)**		
	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK
Al	3.375 761 50	0.35	0.23	3.375 764 15	0.30	0.25	3.375 760 93	0.31	0.85	3.375 761 10		0.88
Zn	2.568 771 37	0.23	0.14	2.568 772 97	0.22	0.16	2.568 763 17	1.34	0.65	2.568 764 20		0.66
Cd	2.219 031 68	0.29	0.08	2.219 033 18	0.21	0.09						
Sn	1.892 716 03	0.09	0.07	1.892 717 23	0.07	0.09	1.892 715 83	0.67	0.44	1.892 718 80		0.46
In	1.609 745 91	0.18	0.04	1.609 747 03	0.01	0.04	1.609 746 07	0.42	0.57	1.609 747 50		0.59
Ga	1.118 127 72	0.04	0.02	1.118 127 72	0.00	0.02	1.118 129 00	0.25	0.12	1.118 129 70		0.13
Hg	0.844 151 02	0.09	0.04	0.844 151 19	0.02	0.05	0.844 151 43	0.22	0.14	0.844 149 90		0.15
Ar	0.215 908 39	0.07	0.03	0.215 908 09	0.03	0.04	0.215 907 20	0.55	0.28	0.215 907 60		0.31

	BNM (1030A)			**SMU (1030B)**			**NPL (1030B)**			**BIPM (1030B)**		
	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK	avg. $W(T_{90})$	range $W(T_{90})$, mK	u_c (k=1), mK
Al	3.375 762 55	0.08	1.12	3.375 759 47	4.59	0.47						
Zn	2.568 762 04	1.16	0.52	2.568 761 80	0.40	0.41	2.568 762 50	0.29	0.44			
Cd												
Sn	1.892 712 54	0.93	0.48	1.892 714 73	1.27	0.45	1.892 717 93	0.75	0.36			
In	1.609 744 72	0.32	0.32				1.609 747 70	0.05	0.34			
Ga	1.118 128 85	0.12	0.15	1.118 128 67	0.03	0.10	1.118 128 30		0.22	1.118 128 80	0.02	0.08
Hg	0.844 149 44		0.29				0.844 151 15	0.17	0.20			
Ar	0.215 905 47		0.31				0.215 903 23	0.37	0.35			

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM. dir. means direct and inc. means inclusive.

Dir	BNM/INM			BIPM			BNM/INM-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 693 08	1.12	711852	NA	NA	NA	NA	NA	NA
Zn FP	2.568 719 35	0.52	75	NA	NA	NA	NA	NA	NA
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 51	0.48	468	NA	NA	NA	NA	NA	NA
In FP	1.609 724 31	0.32	2205	NA	NA	NA	NA	NA	NA
Ga MP	1.118 123 65	0.15	8611	1.118 123 20	0.08	198	0.11	0.17	0.34
Hg TP	0.844 156 18	0.29	5581	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 01	0.31	156	NA	NA	NA	NA	NA	NA

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inc	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST						BIPM						BNM/INM-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	0.06	0.17	0.33
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

dir & inc	IMGC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385

	NIST						BIPM						IMGC-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	0.18	0.10	0.20
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

dir & inc	KRISS			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022
Cd FP	NA	NA	NA	2.218 980 47	0.07	55
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625

	NIST						BIPM						KRISS-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	0.09	0.22	0.48
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

dir & inc	MSL			NIST		
Fixed-Point	*W* (T_{90}) s/n 1032	u_c (*k*=1)	*DF*	*W* (T_{90}) s/n 1032	u_c (*k*=1)	*DF*
Al FP	NA	NA	NA	3.375 711 84	0.21	686
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022
Cd FP	NA	NA	NA	2.219 014 25	0.07	55
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625

	NIST						BIPM						MSL-BIPM		
Fixed-Point	*W* (T_{90}) s/n 4385	u_c (*k*=1)	*DF*	*W* (T_{90}) s/n 1030B	u_c (*k*=1)	*DF*	*W* (T_{90}) s/n 4385	u_c (*k*=1)	*DF*	*W* (T_{90}) s/n 1030B	u_c (*k*=1)	*DF*	dir & inc ΔT, mK	u_c (*k*=1)	*U* (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	0.26	0.20	0.39
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

dir & inc	NIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625

	NIST						BIPM						NIM-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	-0.50	0.29	0.59
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

dir & inc	NIST						BIPM						NIST-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	0.09	0.08	0.16
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

dir & inc	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST						BIPM						NML-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	-0.07	0.15	0.30
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

dir & inc.	NPL						BIPM						NPL-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 123 20	0.08	198	1.118 128 80	0.08	198	-0.08	0.23	0.45
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	NA	NA	NA	NA	NA	NA	NA	NA	NA

dir & inc	NRC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625

	NIST						BIPM						NRC-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	-0.05	0.15	0.31
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	**NRLM**			**NML**		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						**NIST**					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST						**BIPM**						**NRLM-BIPM**		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	-0.28	0.14	0.27
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

dir.	PTB						BIPM						PTB-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 761 10	0.88	3670	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 714 64	0.64	1261745	2.568 764 20	0.66	54953	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 718 80	0.46	12660	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 723 74	0.57	79186	1.609 747 50	0.59	3829	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 16	0.12	176720	1.118 129 70	0.13	9094	1.118 123 20	0.08	198	1.118 128 80	0.08	198	0.24	0.15	0.29
Hg TP	0.844 157 80	0.14	79186	0.844 149 90	0.15	3829	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 945 82	0.28	14496	0.215 907 60	0.31	881	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

inc. Fixed-Point	PTB								
	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

Fixed-Point	NIST								
	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

Fixed-Point	NIST						BIPM						PTB-BIPM		
	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	0.30	0.14	0.29
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

dir & inc	SMU						BIPM						SMU-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 123 20	0.08	198	1.118 128 80	0.08	198	0.13	0.12	0.24
Hg TP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

dir.	VNIIM			BIPM			VNIIM-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 678 20	0.54	5	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 20	0.54	5	NA	NA	NA	NA	NA	NA
Cd FP	2.218 988 54	0.53	4	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 50	0.28	5	NA	NA	NA	NA	NA	NA
In FP	1.609 728 36	0.29	6	NA	NA	NA	NA	NA	NA
Ga MP	1.118 125 03	0.08	8	1.118 123 20	0.08	198	0.46	0.11	0.25
Hg TP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

inc.	VNIIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148
Hg TP	NA	NA	NA	0.844 157 56	0.04	303
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625

	NIST						BIPM						VNIIM-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	0.10	0.11	0.24
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Differences in realization of ITS-90 between Laboratory X and BIPM (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625

	NIST						BIPM						VSL-BIPM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA	NA	NA	NA	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 20	0.08	198	1.118 128 80	0.08	198	-0.13	0.22	0.44
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM. dir. means direct and inc. means inclusive.

dir.	BIPM			BNM/INM			BIPM-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U(95%)
Al FP	NA	NA	NA	3.375 693 08	1.12	711852	NA	NA	NA
Zn FP	NA	NA	NA	2.568 719 35	0.52	75	NA	NA	NA
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	NA	NA	NA	1.892 685 51	0.48	468	NA	NA	NA
In FP	NA	NA	NA	1.609 724 31	0.32	2205	NA	NA	NA
Ga MP	1.118 123 20	0.08	198	1.118 123 65	0.15	8611	-0.11	0.17	0.34
Hg TP	NA	NA	NA	0.844 156 18	0.29	5581	NA	NA	NA
Ar TP	NA	NA	NA	0.215 947 01	0.31	156	NA	NA	NA

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inc.	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST						BNM/INM						BIPM-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U(95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	-0.06	0.17	0.33
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	NA	NA	NA

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

dir & inc	IMGC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385

	NIST						BNM/INM						IMGC-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-4.69	1.25	2.46
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-1.29	0.66	1.33
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	0.37	0.53	1.04
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	0.37	0.45	0.89
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	0.11	0.16	0.32
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.29	0.32	0.62
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	1.08	0.37	0.78

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

dir & inc	KRISS			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022
Cd FP	NA	NA	NA	2.218 980 47	0.07	55
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625

	NIST						BNM/INM						KRISS-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-6.21	1.59	3.36
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-1.02	0.80	1.67
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	-0.02	0.67	1.39
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.96	0.50	0.98
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	0.02	0.25	0.54
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.87	0.36	0.73
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	NA	NA	NA

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

dir & inc	MSL			NIST		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	NA	NA	NA	3.375 711 84	0.21	686
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022
Cd FP	NA	NA	NA	2.219 014 25	0.07	55
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625

	NIST						BNM/INM						MSL-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-0.74	1.13	5.51
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	-0.34	0.68	1.51
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	0.23	0.51	1.06
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	0.20	0.24	0.46
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.63	0.35	0.70
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	NA	NA	NA

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

dir & inc	NIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625

	NIST						BNM/INM						NIM-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-5.49	1.80	3.76
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	0.34	0.75	1.54
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	-0.68	1.66	5.73
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	-0.98	0.56	1.13
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	-0.56	0.32	0.64
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.58	0.37	0.76
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.11	0.41	0.88

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dir & inc	NIST						BNM/INM						NIST-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-2.33	1.14	2.25
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	0.01	0.51	1.01
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	0.50	0.48	0.94
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	0.63	0.33	0.64
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	0.03	0.15	0.29
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.37	0.29	0.57
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.35	0.29	0.58

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

dir & inc	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST						BNM/INM						NML-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-3.20	1.22	2.40
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-0.57	0.54	1.07
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	-0.64	0.51	1.00
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	-1.01	0.53	1.04
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	-0.14	0.20	0.39
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.32	0.32	0.62
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	-2.07	0.57	1.12

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dir.	NPL			BNM/INM			NPL-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	NA	NA	NA	3.375 693 08	1.12	711852	NA	NA	NA
Zn FP	2.568 719 60	0.44	7969	2.568 719 35	0.52	75	0.07	0.68	1.35
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 683 05	0.36	1921	1.892 685 51	0.48	468	-0.66	0.61	1.19
In FP	1.609 722 05	0.34	1543	1.609 724 31	0.32	2205	-0.59	0.48	0.93
Ga MP	1.118 123 10	0.22	50	1.118 123 65	0.15	8611	-0.14	0.27	0.54
Hg TP	0.844 158 45	0.20	131	0.844 156 18	0.29	5581	0.57	0.35	0.69
Ar TP	0.215 943 20	0.36	126	0.215 947 01	0.31	156	-0.88	0.48	0.94

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

inc.	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST						BNM/INM						NPL-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-0.13	0.66	1.32
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	0.23	0.60	1.18
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	-0.05	0.47	0.92
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	-0.14	0.26	0.51
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.48	0.34	0.68
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	-0.66	0.45	0.89

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

dir & inc	NRC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625

	NIST						BNM/INM						NRC-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-0.41	1.26	2.48
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-1.14	0.54	1.14
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	-0.85	0.61	1.21
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	-0.40	0.36	0.71
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	-0.11	0.19	0.40
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.59	0.30	0.59
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.45	0.33	0.65

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	NRLM			NML		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST						BNM/INM						NRLM-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-3.98	2.04	4.13
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-2.42	1.15	2.29
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	-0.70	0.65	1.28
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	-0.37	0.56	1.15
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	-0.34	0.19	0.37
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.27	0.41	0.81
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	NA	NA	NA

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

dir.	PTB						BNM/INM						PTB-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-0.29	1.40	2.76
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-0.51	0.81	1.59
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 685 51	0.48	468	1.892 712 54	0.48	468	0.60	0.64	1.26
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	0.10	0.65	1.28
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	0.08	0.19	0.38
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.45	0.32	0.63
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.06	0.40	0.79

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

inc.	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST						BNM/INM						PTB-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-1.29	1.41	2.78
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-1.17	0.81	1.61
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	0.71	0.65	1.27
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	0.32	0.65	1.28
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	0.23	0.19	0.38
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.32	0.32	0.63
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.12	0.40	0.79

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

dir.	SMU			BNM/INM			SMU-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 691 17	0.47	12	3.375 693 08	1.12	711852	-0.60	1.22	2.43
Zn FP	2.568 717 97	0.41	35	2.568 719 35	0.52	75	-0.39	0.66	1.33
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 687 27	0.45	52	1.892 685 51	0.48	468	0.47	0.66	1.32
In FP	NA	NA	NA	1.609 724 31	0.32	2205	NA	NA	NA
Ga MP	1.118 124 37	0.10	229	1.118 123 65	0.15	8611	0.18	0.18	0.35
Hg TP	NA	NA	NA	0.844 156 18	0.29	5581	NA	NA	NA
Ar TP	NA	NA	NA	0.215 947 01	0.31	156	NA	NA	NA

inc.	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST						BNM/INM						SMU-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-1.19	1.22	2.41
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-0.46	0.63	1.26
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	0.37	0.64	1.27
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	0.07	0.18	0.35
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	NA	NA	NA

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

dir.	VNIIM			BNM/INM			VNIIM-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 678 20	0.54	5	3.375 693 08	1.12	711852	-4.64	1.25	2.61
Zn FP	2.568 710 20	0.54	5	2.568 719 35	0.52	75	-2.61	0.75	1.75
Cd FP	2.218 988 54	0.53	4	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 50	0.28	5	1.892 685 51	0.48	468	0.27	0.56	1.18
In FP	1.609 728 36	0.29	6	1.609 724 31	0.32	2205	1.07	0.44	0.95
Ga MP	1.118 125 03	0.08	8	1.118 123 65	0.15	8611	0.35	0.17	0.34
Hg TP	NA	NA	NA	0.844 156 18	0.29	5581	NA	NA	NA
Ar TP	NA	NA	NA	0.215 947 01	0.31	156	NA	NA	NA

inc.	VNIIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148
Hg TP	NA	NA	NA	0.844 157 56	0.04	303
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625

	NIST						BNM/INM						VNIIM-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-2.63	1.26	2.63
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	0.04	0.73	1.72
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	0.71	0.55	1.17
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	0.75	0.44	0.96
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	0.04	0.17	0.34
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	NA	NA	NA

Table 7. Differences in realization of ITS-90 between Laboratory X and BNM/INM (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625

	NIST						BNM/INM						VSL-BNM/INM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	-2.74	1.38	2.72
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 719 35	0.52	75	2.568 762 04	0.52	75	-0.30	0.70	1.38
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 685 51	0.48	468	1.892 712 54	0.48	468	0.07	0.61	1.19
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	-0.58	0.46	0.92
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	-0.20	0.26	0.50
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.41	0.35	0.70
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.29	0.44	0.87

Table 8. Differences in realization of ITS-90 between Laboratory X and IMGC. dir. means direct and inc. means inclusive.

dir & inc	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			IMGC			BIPM-IMGC		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 56	0.25	353	3.375 739 99	0.49	87	NA	NA	NA
Zn FP	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	NA	NA	NA
Cd FP	2.219 024 40	0.09	44	2.219 019 11	0.32	181	NA	NA	NA
Sn FP	1.892 713 55	0.09	335	1.892 713 07	0.21	141	NA	NA	NA
In FP	1.609 745 74	0.04	375	1.609 744 75	0.31	118	NA	NA	NA
Ga MP	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.18	0.10	0.20
Hg TP	0.844 151 53	0.05	281	0.844 151 19	0.13	977	NA	NA	NA
Ar TP	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	NA	NA	NA

Table 8. Differences in realization of ITS-90 between Laboratory X and IMGC (continued). dir. means direct and inc. means inclusive.

dir & inc	BNM/INM						NIST					
Fixed-Point	*W* (T_{90}) s/n 4385	u_c (k=1)	*DF*	*W* (T_{90}) s/n 1030A	u_c (k=1)	*DF*	*W* (T_{90}) s/n 4385	u_c (k=1)	*DF*	*W* (T_{90}) s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST			IMGC			BNM/INM-IMGC		
Fixed-Point	*W* (T_{90}) s/n 1098B	u_c (k=1)	*DF*	*W* (T_{90}) s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 747 56	0.25	353	3.375 739 99	0.49	87	4.69	1.25	2.46
Zn FP	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	1.29	0.66	1.33
Cd FP	2.219 024 40	0.09	44	2.219 019 11	0.32	181	NA	NA	NA
Sn FP	1.892 713 55	0.09	335	1.892 713 07	0.21	141	-0.37	0.53	1.04
In FP	1.609 745 74	0.04	375	1.609 744 75	0.31	118	-0.37	0.45	0.89
Ga MP	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.11	0.16	0.32
Hg TP	0.844 151 53	0.05	281	0.844 151 19	0.13	977	-0.29	0.32	0.62
Ar TP	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	-1.08	0.37	0.78

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dir & inc	KRISS			NIST			NIST			IMGC			KRISS-IMGC		
Fixed-Point	*W* (T_{90}) s/n 4386	u_c (k=1)	*DF*	*W* (T_{90}) s/n 4386	u_c (k=1)	*DF*	*W* (T_{90}) s/n 1098B	u_c (k=1)	*DF*	*W* (T_{90}) s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686	3.375 747 56	0.25	353	3.375 739 99	0.49	87	-1.52	1.24	2.73
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	0.26	0.77	1.61
Cd FP	NA	NA	NA	2.218 980 47	0.07	55	2.219 024 40	0.09	44	2.219 019 11	0.32	181	NA	NA	NA
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372	1.892 713 55	0.09	335	1.892 713 07	0.21	141	-0.40	0.52	1.12
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877	1.609 745 74	0.04	375	1.609 744 75	0.31	118	1.59	0.49	0.97
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.09	0.21	0.47
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303	0.844 151 53	0.05	281	0.844 151 19	0.13	977	0.59	0.25	0.54
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	NA	NA	NA

Table 8. Differences in realization of ITS-90 between Laboratory X and IMGC (continued). dir. means direct and inc. means inclusive.

dir & inc	MSL			NIST			NIST			IMGC			MSL-IMGC		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	3.375 711 84	0.21	686	3.375 747 56	0.25	353	3.375 739 99	0.49	87	NA	NA	NA
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	0.55	1.10	5.50
Cd FP	NA	NA	NA	2.219 014 25	0.07	55	2.219 024 40	0.09	44	2.219 019 11	0.32	181	NA	NA	NA
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372	1.892 713 55	0.09	335	1.892 713 07	0.21	141	-0.71	0.54	1.26
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877	1.609 745 74	0.04	375	1.609 744 75	0.31	118	-0.14	0.51	1.06
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148	1.118 128 35	0.02	646	1.118 128 69	0.06	18	0.08	0.19	0.38
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303	0.844 151 53	0.05	281	0.844 151 19	0.13	977	0.35	0.24	0.49
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	NA	NA	NA

dir & inc	NIM			NIST			NIST			IMGC			NIM-IMGC		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686	3.375 747 56	0.25	353	3.375 739 99	0.49	87	-0.80	1.50	3.21
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	1.63	0.72	1.47
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55	2.219 024 40	0.09	44	2.219 019 11	0.32	181	2.75	0.93	2.07
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372	1.892 713 55	0.09	335	1.892 713 07	0.21	141	-1.05	1.61	5.67
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877	1.609 745 74	0.04	375	1.609 744 75	0.31	118	-1.35	0.56	1.13
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.68	0.29	0.59
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303	0.844 151 53	0.05	281	0.844 151 19	0.13	977	0.29	0.27	0.57
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	-0.97	0.37	0.84

dir & inc	NIST			IMGC			NIST-IMGC		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 56	0.25	353	3.375 739 99	0.49	87	2.36	0.55	1.10
Zn FP	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	1.30	0.45	0.91
Cd FP	2.219 024 40	0.09	44	2.219 019 11	0.32	181	1.47	0.33	0.66
Sn FP	1.892 713 55	0.09	335	1.892 713 07	0.21	141	0.13	0.23	0.44
In FP	1.609 745 74	0.04	375	1.609 744 75	0.31	118	0.26	0.32	0.63
Ga MP	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.09	0.06	0.13
Hg TP	0.844 151 53	0.05	281	0.844 151 19	0.13	977	0.09	0.14	0.27
Ar TP	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	-0.73	0.23	0.52

Table 8. Differences in realization of ITS-90 between Laboratory X and IMGC (continued). dir. means direct and inc. means inclusive.

dir & inc	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			IMGC			NML-IMGC		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 56	0.25	353	3.375 739 99	0.49	87	1.49	0.70	1.38
Zn FP	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	0.72	0.49	0.98
Cd FP	2.219 024 40	0.09	44	2.219 019 11	0.32	181	0.26	0.39	0.77
Sn FP	1.892 713 55	0.09	335	1.892 713 07	0.21	141	-1.01	0.28	0.57
In FP	1.609 745 74	0.04	375	1.609 744 75	0.31	118	-1.39	0.52	1.03
Ga MP	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.25	0.14	0.29
Hg TP	0.844 151 53	0.05	281	0.844 151 19	0.13	977	0.04	0.19	0.37
Ar TP	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	-3.15	0.54	1.10

Table 8. Differences in realization of ITS-90 between Laboratory X and IMGC (continued). dir. means direct and inc. means inclusive.

dir & inc	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			IMGC			NPL-IMGC		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 56	0.25	353	3.375 739 99	0.49	87	NA	NA	NA
Zn FP	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	1.16	0.63	1.25
Cd FP	2.219 024 40	0.09	44	2.219 019 11	0.32	181	NA	NA	NA
Sn FP	1.892 713 55	0.09	335	1.892 713 07	0.21	141	-0.14	0.43	0.84
In FP	1.609 745 74	0.04	375	1.609 744 75	0.31	118	-0.42	0.46	0.91
Ga MP	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.25	0.22	0.44
Hg TP	0.844 151 53	0.05	281	0.844 151 19	0.13	977	0.19	0.23	0.46
Ar TP	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	-1.74	0.41	0.85

dir & inc	NRC			NIST			NIST			IMGC			NRC-IMGC		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686	3.375 747 56	0.25	353	3.375 739 99	0.49	87	4.29	0.75	1.49
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	0.15	0.48	1.04
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55	2.219 024 40	0.09	44	2.219 019 11	0.32	181	0.51	0.38	0.77
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372	1.892 713 55	0.09	335	1.892 713 07	0.21	141	-1.22	0.44	0.88
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877	1.609 745 74	0.04	375	1.609 744 75	0.31	118	-0.77	0.35	0.70
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.23	0.14	0.30
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303	0.844 151 53	0.05	281	0.844 151 19	0.13	977	0.30	0.16	0.31
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	-0.63	0.28	0.60

Table 8. Differences in realization of ITS-90 between Laboratory X and IMGC (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	NRLM			NML		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			IMGC			NRLM-IMGC		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 56	0.25	353	3.375 739 99	0.49	87	0.72	1.78	3.64
Zn FP	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	-1.13	1.13	2.25
Cd FP	2.219 024 40	0.09	44	2.219 019 11	0.32	181	NA	NA	NA
Sn FP	1.892 713 55	0.09	335	1.892 713 07	0.21	141	-1.07	0.49	0.98
In FP	1.609 745 74	0.04	375	1.609 744 75	0.31	118	-0.74	0.56	1.14
Ga MP	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.46	0.13	0.26
Hg TP	0.844 151 53	0.05	281	0.844 151 19	0.13	977	-0.02	0.33	0.64
Ar TP	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	NA	NA	NA

Table 8. Differences in realization of ITS-90 between Laboratory X and IMGC (continued). dir. means direct and inc. means inclusive.

dir & inc	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST			IMGC			PTB-IMGC		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 56	0.25	353	3.375 739 99	0.49	87	3.40	1.00	1.98
Zn FP	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	0.12	0.78	1.55
Cd FP	2.219 024 40	0.09	44	2.219 019 11	0.32	181	NA	NA	NA
Sn FP	1.892 713 55	0.09	335	1.892 713 07	0.21	141	0.33	0.49	0.97
In FP	1.609 745 74	0.04	375	1.609 744 75	0.31	118	-0.05	0.65	1.28
Ga MP	1.118 128 35	0.02	646	1.118 128 69	0.06	18	0.12	0.14	0.27
Hg TP	0.844 151 53	0.05	281	0.844 151 19	0.13	977	0.03	0.20	0.39
Ar TP	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	-0.96	0.36	0.75

Table 8. Differences in realization of ITS-90 between Laboratory X and IMGC (continued). dir. means direct and inc. means inclusive.

dir & inc	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			IMGC			SMU-IMGC		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	DF	$W(T_{90})$ s/n 1098B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 56	0.25	353	3.375 739 99	0.49	87	3.50	0.70	1.41
Zn FP	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	0.83	0.59	1.19
Cd FP	2.219 024 40	0.09	44	2.219 019 11	0.32	181	NA	NA	NA
Sn FP	1.892 713 55	0.09	335	1.892 713 07	0.21	141	0.00	0.49	0.97
In FP	1.609 745 74	0.04	375	1.609 744 75	0.31	118	NA	NA	NA
Ga MP	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.05	0.11	0.23
Hg TP	0.844 151 53	0.05	281	0.844 151 19	0.13	977	NA	NA	NA
Ar TP	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	NA	NA	NA

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dir & inc	VNIIM			NIST			NIST			IMGC			VNIIM-IMGC		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	W (T_{90}) s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1098B	u_c (k=1)	DF	$W(T_{90})$ s/n 1098B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686	3.375 747 56	0.25	353	3.375 739 99	0.49	87	2.06	0.77	1.78
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	1.33	0.70	1.67
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55	2.219 024 40	0.09	44	2.219 019 11	0.32	181	1.87	0.63	1.60
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372	1.892 713 55	0.09	335	1.892 713 07	0.21	141	0.33	0.36	0.84
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877	1.609 745 74	0.04	375	1.609 744 75	0.31	118	0.38	0.43	0.95
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.08	0.10	0.23
Hg TP	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 53	0.05	281	0.844 151 19	0.13	977	NA	NA	NA
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	NA	NA	NA

Table 8. Differences in realization of ITS-90 between Laboratory X and IMGC (continued). dir. means direct and inc. means inclusive.

dir & inc	**VSL**			**NIST**			**NIST**			**IMGC**			**VSL-IMGC**		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686	3.375 747 56	0.25	353	3.375 739 99	0.49	87	1.95	0.95	1.88
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022	2.568 759 10	0.16	1059	2.568 754 54	0.42	40	0.99	0.66	1.31
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55	2.219 024 40	0.09	44	2.219 019 11	0.32	181	0.33	NA	NA
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372	1.892 713 55	0.09	335	1.892 713 07	0.21	141	-0.30	0.44	0.86
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877	1.609 745 74	0.04	375	1.609 744 75	0.31	118	-0.96	0.46	0.91
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148	1.118 128 35	0.02	646	1.118 128 69	0.06	18	-0.31	0.22	0.43
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303	0.844 151 53	0.05	281	0.844 151 19	0.13	977	0.13	0.25	0.49
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625	0.215 909 29	0.04	2385	0.215 912 46	0.23	9	-0.79	0.40	0.84

Table 9. Differences in realization of ITS-90 between Laboratory X and KRISS. dir. means direct and inc. means inclusive.

dir & inc	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			KRISS			BIPM-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 661 60	1.11	9	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	NA	NA	NA
Cd FP	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 679 30	0.46	10	NA	NA	NA
In FP	1.609 724 44	0.04	877	1.609 729 50	0.38	112	NA	NA	NA
Ga MP	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	-0.09	0.22	0.48
Hg TP	0.844 159 29	0.04	303	0.844 161 30	0.21	11	NA	NA	NA
Ar TP	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

Table 9. Differences in realization of ITS-90 between Laboratory X and KRISS (continued) dir. means direct and inc. means inclusive.

dir & inc	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST			KRISS			BNM/INM-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 661 60	1.11	9	6.21	1.59	3.36
Zn FP	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	1.02	0.80	1.67
Cd FP	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 679 30	0.46	10	0.02	0.67	1.39
In FP	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-1.96	0.50	0.98
Ga MP	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	-0.02	0.25	0.54
Hg TP	0.844 159 29	0.04	303	0.844 161 30	0.21	11	-0.87	0.36	0.73
Ar TP	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

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dir & inc	IMGC			NIST			NIST			KRISS			IMGC-KRISS		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	DF	$W(T_{90})$ s/n 1098B	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353	3.375 674 05	0.21	686	3.375 661 60	1.11	9	1.52	1.24	2.73
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	-0.26	0.77	1.61
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335	1.892 681 25	0.06	372	1.892 679 30	0.46	10	0.40	0.52	1.12
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-1.59	0.49	0.97
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	0.09	0.21	0.47
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281	0.844 159 29	0.04	303	0.844 161 30	0.21	11	-0.59	0.25	0.54
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

Table 9. Differences in realization of ITS-90 between Laboratory X and KRISS. dir. means direct and inc. means inclusive.

dir & inc	MSL			NIST			NIST			KRISS			MSL-KRISS		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	3.375 711 84	0.21	686	3.375 674 05	0.21	686	3.375 661 60	1.11	9	NA	NA	NA
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	0.29	1.19	5.59
Cd FP	NA	NA	NA	2.219 014 25	0.07	55	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372	1.892 681 25	0.06	372	1.892 679 30	0.46	10	-0.31	0.67	1.56
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-1.73	0.55	1.13
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	0.17	0.27	0.58
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303	0.844 159 29	0.04	303	0.844 161 30	0.21	11	-0.24	0.29	0.62
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

dir & inc	NIM			KRISS			NIM-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 663 92	1.39	13	3.375 661 60	1.11	9	0.72	1.78	3.92
Zn FP	2.568 704 79	0.56	21	2.568 700 00	0.63	15	1.37	0.84	1.77
Cd FP	2.218 985 09	0.86	9	NA	NA	NA	NA	NA	NA
Sn FP	1.892 676 88	1.59	3	1.892 679 30	0.46	10	-0.65	1.66	5.74
In FP	1.609 718 33	0.46	28	1.609 729 50	0.38	112	-2.94	0.59	1.20
Ga MP	1.118 122 28	0.28	36	1.118 124 60	0.20	10	-0.59	0.35	0.73
Hg TP	0.844 160 13	0.23	14	0.844 161 30	0.21	11	-0.29	0.31	0.68
Ar TP	0.215 952 54	0.28	8	NA	NA	NA	NA	NA	NA

dir & inc	NIST			KRISS			NIST-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 661 60	1.11	9	3.88	1.13	2.54
Zn FP	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	1.04	0.64	1.36
Cd FP	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 679 30	0.46	10	0.53	0.46	1.03
In FP	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-1.33	0.38	0.75
Ga MP	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	0.00	0.20	0.46
Hg TP	0.844 159 29	0.04	303	0.844 161 30	0.21	11	-0.50	0.21	0.47
Ar TP	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

Table 9. Differences in realization of ITS-90 between Laboratory X and KRISS (continued). dir. means direct and inc. means inclusive.

dir.	NML			KRISS			NML-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 671 26	0.43	215	3.375 661 60	1.11	9	3.01	1.19	2.65
Zn FP	2.568 701 29	0.21	267	2.568 700 00	0.63	15	0.37	0.66	1.40
Cd FP	2.218 974 91	0.18	236	NA	NA	NA	NA	NA	NA
Sn FP	1.892 676 09	0.15	207	1.892 679 30	0.46	10	-0.86	0.49	1.06
In FP	1.609 716 06	0.41	181	1.609 729 50	0.38	112	-3.54	0.56	1.11
Ga MP	1.118 123 46	0.13	186	1.118 124 60	0.20	10	-0.29	0.24	0.52
Hg TP	0.844 158 14	0.13	182	0.844 161 30	0.21	11	-0.79	0.24	0.52
Ar TP	0.215 941 86	0.49	120	NA	NA	NA	NA	NA	NA

inc.	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			KRISS			NML-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 661 60	1.11	9	3.01	1.19	2.65
Zn FP	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	0.45	0.66	1.40
Cd FP	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 679 30	0.46	10	-0.61	0.49	1.08
In FP	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-2.98	0.56	1.11
Ga MP	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	-0.16	0.24	0.52
Hg TP	0.844 159 29	0.04	303	0.844 161 30	0.21	11	-0.55	0.24	0.53
Ar TP	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

Table 9. Differences in realization of ITS-90 between Laboratory X and KRISS (continued). dir. means direct and inc. means inclusive.

dir & inc	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			KRISS			NPL-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 661 60	1.11	9	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	0.90	0.77	1.61
Cd FP	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 679 30	0.46	10	0.26	0.59	1.25
In FP	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-2.02	0.51	1.00
Ga MP	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	-0.16	0.29	0.62
Hg TP	0.844 159 29	0.04	303	0.844 161 30	0.21	11	-0.40	0.28	0.60
Ar TP	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

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dir & inc	NRC			NIST			NIST			KRISS			NRC-KRISS		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686	3.375 674 05	0.21	686	3.375 661 60	1.11	9	5.81	1.25	2.75
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	-0.12	0.67	1.47
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372	1.892 681 25	0.06	372	1.892 679 30	0.46	10	-0.82	0.60	1.28
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-2.36	0.41	0.81
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	-0.13	0.24	0.53
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303	0.844 159 29	0.04	303	0.844 161 30	0.21	11	-0.28	0.23	0.50
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

Table 9. Differences in realization of ITS-90 between Laboratory X and KRISS (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir	**NRLM**			**NML**			**NML**			**KRISS**			**NRLM-KRISS**		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240	3.375 671 26	0.43	215	3.375 661 60	1.11	9	2.24	2.02	4.28
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344	2.568 701 29	0.21	267	2.568 700 00	0.63	15	-1.48	1.21	2.46
Cd FP	NA	NA	NA	2.218 939 38	0.20	305	2.218 974 91	0.18	236	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245	1.892 676 09	0.15	207	1.892 679 30	0.46	10	-0.93	0.63	1.33
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183	1.609 716 06	0.41	181	1.609 729 50	0.38	112	-2.89	0.59	1.21
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194	1.118 123 46	0.13	186	1.118 124 60	0.20	10	-0.50	0.23	0.51
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186	0.844 158 14	0.13	182	0.844 161 30	0.21	11	-0.85	0.36	0.74
Ar TP	NA	NA	NA	NA	NA	NA	0.215 941 86	0.49	120	NA	NA	NA	NA	NA	NA

Table 9. Differences in realization of ITS-90 between Laboratory X and KRISS (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

inc	NRLM			NML		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			KRISS			NRLM-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 661 60	1.11	9	2.24	2.02	4.28
Zn FP	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	-1.40	1.21	2.46
Cd FP	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 679 30	0.46	10	-0.68	0.63	1.34
In FP	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-2.33	0.60	1.21
Ga MP	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	-0.37	0.23	0.51
Hg TP	0.844 159 29	0.04	303	0.844 161 30	0.21	11	-0.61	0.36	0.74
Ar TP	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

Table 9. Differences in realization of ITS-90 between Laboratory X and KRISS (continued). dir. means direct and inc. means inclusive.

dir & inc	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST			KRISS			PTB-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 661 60	1.11	9	4.92	1.41	3.03
Zn FP	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	-0.15	0.91	1.86
Cd FP	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 679 30	0.46	10	0.73	0.64	1.34
In FP	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-1.64	0.68	1.34
Ga MP	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	0.21	0.24	0.52
Hg TP	0.844 159 29	0.04	303	0.844 161 30	0.21	11	-0.56	0.26	0.54
Ar TP	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

Table 9. Differences in realization of ITS-90 between Laboratory X and KRISS (continued). dir. means direct and inc. means inclusive.

dir & inc	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			KRISS			SMU-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 661 60	1.11	9	5.02	1.21	2.69
Zn FP	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	0.56	0.75	1.57
Cd FP	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 679 30	0.46	10	0.39	0.64	1.34
In FP	1.609 724 44	0.04	877	1.609 729 50	0.38	112	NA	NA	NA
Ga MP	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	0.04	0.23	0.50
Hg TP	0.844 159 29	0.04	303	0.844 161 30	0.21	11	NA	NA	NA
Ar TP	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

dir & inc	VNIIM			NIST			NIST			KRISS			VNIIM-KRISS		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686	3.375 674 05	0.21	686	3.375 661 60	1.11	9	3.58	1.25	2.90
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	1.06	0.84	1.96
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372	1.892 681 25	0.06	372	1.892 679 30	0.46	10	0.73	0.54	1.25
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-1.22	0.48	1.03
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	0.01	0.22	0.49
Hg TP	NA	NA	NA	0.844 157 56	0.04	303	0.844 159 29	0.04	303	0.844 161 30	0.21	11	NA	NA	NA
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

Table 9. Differences in realization of ITS-90 between Laboratory X and KRISS (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST			NIST			KRISS			VSL-KRISS		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686	3.375 674 05	0.21	686	3.375 661 60	1.11	9	3.47	1.37	2.96
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022	2.568 703 63	0.13	2022	2.568 700 00	0.63	15	0.73	0.80	1.66
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55	2.218 980 47	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372	1.892 681 25	0.06	372	1.892 679 30	0.46	10	0.10	0.60	1.26
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877	1.609 724 44	0.04	877	1.609 729 50	0.38	112	-2.55	0.50	1.00
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148	1.118 124 62	0.01	1148	1.118 124 60	0.20	10	-0.22	0.29	0.62
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303	0.844 159 29	0.04	303	0.844 161 30	0.21	11	-0.46	0.30	0.62
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625	0.215 953 56	0.03	6625	NA	NA	NA	NA	NA	NA

Table 10. Differences in realization of ITS-90 between Laboratory X and MSL. dir. means direct and inc. means inclusive.

dir & inc	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			MSL			BIPM-MSL		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	NA	NA	NA
Cd FP	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 706 86	0.06	372	1.892 703 74	0.47	6	NA	NA	NA
In FP	1.609 741 29	0.04	877	1.609 739 76	0.39	14	NA	NA	NA
Ga MP	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.26	0.20	0.39
Hg TP	0.844 151 65	0.04	303	0.844 152 71	0.19	21	NA	NA	NA
Ar TP	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

Table 10. Differences in realization of ITS-90 between Laboratory X and MSL (continued). dir. means direct and inc. means inclusive.

dir & inc	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST			MSL			BNM/INM-MSL		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	0.74	1.13	5.51
Cd FP	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 706 86	0.06	372	1.892 703 74	0.47	6	0.34	0.68	1.51
In FP	1.609 741 29	0.04	877	1.609 739 76	0.39	14	-0.23	0.51	1.06
Ga MP	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.20	0.24	0.46
Hg TP	0.844 151 65	0.04	303	0.844 152 71	0.19	21	-0.63	0.35	0.70
Ar TP	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

dir & inc	IMGC			NIST			NIST			MSL			IMGC-MSL		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	-0.55	1.10	5.50
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335	1.892 706 86	0.06	372	1.892 703 74	0.47	6	0.71	0.54	1.26
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375	1.609 741 29	0.04	877	1.609 739 76	0.39	14	0.14	0.51	1.06
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.08	0.19	0.38
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281	0.844 151 65	0.04	303	0.844 152 71	0.19	21	-0.35	0.24	0.49
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

Table 10. Differences in realization of ITS-90 between Laboratory X and MSL (continued). dir. means direct and inc. means inclusive.

dir & inc	KRISS			NIST			NIST			MSL			KRISS-MSL		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	-0.29	1.19	5.59
Cd FP	NA	NA	NA	2.218 980 47	0.07	55	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 703 74	0.47	6	0.31	0.67	1.56
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 739 76	0.39	14	1.73	0.55	1.13
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.17	0.27	0.58
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 152 71	0.19	21	0.24	0.29	0.62
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

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dir & inc	NIM			NIST			NIST			MSL			NIM-MSL		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	1.08	1.16	5.55
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 703 74	0.47	6	-0.34	1.66	5.77
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 739 76	0.39	14	-1.21	0.61	1.27
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.76	0.34	0.68
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 152 71	0.19	21	-0.06	0.31	0.65
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

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dir & inc	NIST			MSL			NIST-MSL		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	0.75	1.01	5.43
Cd FP	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 706 86	0.06	372	1.892 703 74	0.47	6	0.84	0.49	1.18
In FP	1.609 741 29	0.04	877	1.609 739 76	0.39	14	0.40	0.40	0.85
Ga MP	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.17	0.18	0.36
Hg TP	0.844 151 65	0.04	303	0.844 152 71	0.19	21	-0.26	0.20	0.41
Ar TP	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

Table 10. Differences in realization of ITS-90 between Laboratory X and MSL (continued). dir. means direct and inc. means inclusive.

dir.	NML			MSL			NML-MSL		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 741 40	0.24	344	2.568 740 53	1.01	2	0.25	1.03	5.44
Cd FP	2.219 011 08	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 703 57	0.16	245	1.892 703 74	0.47	6	-0.05	0.51	1.22
In FP	1.609 737 15	0.42	183	1.609 739 76	0.39	14	-0.69	0.58	1.18
Ga MP	1.118 127 46	0.13	194	1.118 128 26	0.18	1155135	-0.20	0.22	0.44
Hg TP	0.844 152 43	0.13	191	0.844 152 71	0.19	21	-0.07	0.23	0.47
Ar TP	0.215 904 58	0.49	120	NA	NA	NA	NA	NA	NA

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inc.	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			MSL			NML-MSL		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	0.17	1.03	5.44
Cd FP	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 706 86	0.06	372	1.892 703 74	0.47	6	-0.30	0.51	1.23
In FP	1.609 741 29	0.04	877	1.609 739 76	0.39	14	-1.25	0.58	1.18
Ga MP	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.33	0.22	0.44
Hg TP	0.844 151 65	0.04	303	0.844 152 71	0.19	21	-0.31	0.23	0.47
Ar TP	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

Table 10. Differences in realization of ITS-90 between Laboratory X and MSL (continued). dir. means direct and inc. means inclusive.

dir & inc	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			MSL			NPL-MSL		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	0.61	1.10	5.49
Cd FP	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 706 86	0.06	372	1.892 703 74	0.47	6	0.57	0.61	1.38
In FP	1.609 741 29	0.04	877	1.609 739 76	0.39	14	-0.28	0.52	1.08
Ga MP	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.34	0.28	0.55
Hg TP	0.844 151 65	0.04	303	0.844 152 71	0.19	21	-0.16	0.27	0.55
Ar TP	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

dir & inc	NRC			NIST			NIST			MSL			NRC-MSL		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	DF	$W(T_{90})$ s/n 1098A	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	-0.40	1.03	5.45
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372	1.892 706 86	0.06	372	1.892 703 74	0.47	6	-0.51	0.62	1.41
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877	1.609 741 29	0.04	877	1.609 739 76	0.39	14	-0.63	0.43	0.91
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.31	0.22	0.45
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303	0.844 151 65	0.04	303	0.844 152 71	0.19	21	-0.05	0.21	0.44
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

Table 10. Differences in realization of ITS-90 between Laboratory X and MSL (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir	NRLM			NML			NML			MSL			NRLM-MSL		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344	2.568 741 40	0.24	344	2.568 740 53	1.01	2	-1.60	1.45	5.81
Cd FP	NA	NA	NA	2.218 939 38	0.20	305	2.219 011 08	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245	1.892 703 57	0.16	245	1.892 703 74	0.47	6	-0.11	0.65	1.46
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183	1.609 737 15	0.42	183	1.609 739 76	0.39	14	-0.04	0.61	1.28
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194	1.118 127 46	0.13	194	1.118 128 26	0.18	1155135	-0.41	0.21	0.42
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186	0.844 152 43	0.13	191	0.844 152 71	0.19	21	-0.13	0.36	0.71
Ar TP	NA	NA	NA	NA	NA	NA	0.215 904 58	0.49	120	NA	NA	NA	NA	NA	NA

Table 10. Differences in realization of ITS-90 between Laboratory X and MSL (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

inc	NRLM			NML		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			MSL			NRLM-MSL		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	-1.68	1.44	5.80
Cd FP	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 706 86	0.06	372	1.892 703 75	0.47	6	-0.36	0.65	1.47
In FP	1.609 741 29	0.04	877	1.609 739 76	0.39	14	-0.60	0.61	1.28
Ga MP	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.54	0.22	0.42
Hg TP	0.844 151 65	0.04	303	0.844 152 71	0.19	21	-0.37	0.36	0.71
Ar TP	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

Table 10. Differences in realization of ITS-90 between Laboratory X and MSL (continued). dir. means direct and inc. means inclusive.

dir & inc	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST			MSL			PTB-MSL		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	-0.43	1.20	5.57
Cd FP	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 706 86	0.06	372	1.892 703 74	0.47	6	1.04	0.66	1.46
In FP	1.609 741 29	0.04	877	1.609 739 76	0.39	14	0.09	0.69	1.40
Ga MP	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	0.03	0.22	0.43
Hg TP	0.844 151 65	0.04	303	0.844 152 71	0.19	21	-0.32	0.24	0.50
Ar TP	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

Table 10. Differences in realization of ITS-90 between Laboratory X and MSL (continued). dir. means direct and inc. means inclusive.

dir & inc	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			MSL			SMU-MSL		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	0.28	1.09	5.48
Cd FP	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 706 86	0.06	372	1.892 703 74	0.47	6	0.71	0.65	1.46
In FP	1.609 741 29	0.04	877	1.609 739 76	0.39	14	NA	NA	NA
Ga MP	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.13	0.21	0.41
Hg TP	0.844 151 65	0.04	303	0.844 152 71	0.19	21	NA	NA	NA
Ar TP	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

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dir & inc	VNIIM			NIST			NIST			MSL			VNIIM-MSL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	0.78	1.15	5.61
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372	1.892 706 86	0.06	372	1.892 703 74	0.47	6	1.04	0.57	1.38
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877	1.609 741 29	0.04	877	1.609 739 76	0.39	14	0.52	0.50	1.11
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.16	0.20	0.40
Hg TP	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 65	0.04	303	0.844 152 71	0.19	21	NA	NA	NA
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

Table 10. Differences in realization of ITS-90 between Laboratory X and MSL (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST			NIST			MSL			VSL-MSL		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686	3.375 711 84	0.21	686	NA	NA	NA	NA	NA	NA
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022	2.568 743 16	0.13	2022	2.568 740 53	1.01	2	0.44	1.12	5.51
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55	2.219 014 25	0.07	55	NA	NA	NA	NA	NA	NA
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372	1.892 706 86	0.06	372	1.892 703 74	0.47	6	0.41	0.62	1.39
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877	1.609 741 29	0.04	877	1.609 739 76	0.39	14	-0.81	0.52	1.08
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148	1.118 127 59	0.01	1148	1.118 128 26	0.18	1155135	-0.40	0.28	0.55
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303	0.844 151 65	0.04	303	0.844 152 71	0.19	21	-0.22	0.29	0.58
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625	0.215 913 88	0.03	6625	NA	NA	NA	NA	NA	NA

Table 11. Differences in realization of ITS-90 between Laboratory X and NIM. dir. means direct and inc. means inclusive.

dir & inc	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			NIM			BIPM-NIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 663 92	1.39	13	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	NA	NA	NA
Cd FP	2.218 980 47	0.07	55	2.218 985 09	0.86	9	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 676 88	1.59	3	NA	NA	NA
In FP	1.609 724 44	0.04	877	1.609 718 33	0.46	28	NA	NA	NA
Ga MP	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.50	0.29	0.59
Hg TP	0.844 159 29	0.04	303	0.844 160 13	0.23	14	NA	NA	NA
Ar TP	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	NA	NA	NA

Table 11. Differences in realization of ITS-90 between Laboratory X and NIM. dir. means direct and inc. means inclusive.

dir & inc	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST			NIM			BNM/INM-NIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 663 92	1.39	13	5.49	1.80	3.76
Zn FP	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-0.34	0.75	1.54
Cd FP	2.218 980 47	0.07	55	2.218 985 09	0.86	9	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 676 88	1.59	3	0.68	1.66	5.73
In FP	1.609 724 44	0.04	877	1.609 718 33	0.46	28	0.98	0.56	1.13
Ga MP	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.56	0.32	0.64
Hg TP	0.844 159 29	0.04	303	0.844 160 13	0.23	14	-0.58	0.37	0.76
Ar TP	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	-0.11	0.41	0.88

dir & inc	IMGC			NIST			NIST			NIM			IMGC-NIM		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353	3.375 674 05	0.21	686	3.375 663 92	1.39	13	0.80	1.50	3.21
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-1.63	0.72	1.47
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44	2.218 980 47	0.07	55	2.218 985 09	0.86	9	-2.75	0.93	2.07
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335	1.892 681 25	0.06	372	1.892 676 88	1.59	3	1.05	1.61	5.67
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375	1.609 724 44	0.04	877	1.609 718 33	0.46	28	1.35	0.56	1.13
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.68	0.29	0.59
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281	0.844 159 29	0.04	303	0.844 160 13	0.23	14	-0.29	0.27	0.57
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	0.97	0.37	0.84

Table 11. Differences in realization of ITS-90 between Laboratory X and NIM (continued). dir. means direct and inc. means inclusive.

dir & inc	KRISS			NIM			KRISS-NIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 661 60	1.11	9	3.375 663 92	1.39	13	-0.72	1.78	3.92
Zn FP	2.568 700 00	0.63	15	2.568 704 79	0.56	21	-1.37	0.84	1.77
Cd FP	NA	NA	NA	2.218 985 09	0.86	9	NA	NA	NA
Sn FP	1.892 679 30	0.46	10	1.892 676 88	1.59	3	0.65	1.66	5.74
In FP	1.609 729 50	0.38	112	1.609 718 33	0.46	28	2.94	0.59	1.20
Ga MP	1.118 124 60	0.20	10	1.118 122 28	0.28	36	0.59	0.35	0.73
Hg TP	0.844 161 30	0.21	11	0.844 160 13	0.23	14	0.29	0.31	0.68
Ar TP	NA	NA	NA	0.215 952 54	0.28	8	NA	NA	NA

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dir & inc	MSL			NIST			NIST			NIM			MSL-NIM		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	3.375 711 84	0.21	686	3.375 674 05	0.21	686	3.375 663 92	1.39	13	NA	NA	NA
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-1.08	1.16	5.55
Cd FP	NA	NA	NA	2.219 014 25	0.07	55	2.218 980 47	0.07	55	2.218 985 09	0.86	9	NA	NA	NA
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372	1.892 681 25	0.06	372	1.892 676 88	1.59	3	0.34	1.66	5.77
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877	1.609 724 44	0.04	877	1.609 718 33	0.46	28	1.21	0.61	1.27
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.76	0.34	0.68
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303	0.844 159 29	0.04	303	0.844 160 13	0.23	14	0.06	0.31	0.65
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	NA	NA	NA

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dir & inc	NIST			NIM			NIST-NIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 663 92	1.39	13	3.16	1.41	3.04
Zn FP	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-0.33	0.58	1.19
Cd FP	2.218 980 47	0.07	55	2.218 985 09	0.86	9	-1.28	0.87	1.96
Sn FP	1.892 681 25	0.06	372	1.892 676 88	1.59	3	1.18	1.59	5.65
In FP	1.609 724 44	0.04	877	1.609 718 33	0.46	28	1.61	0.46	0.94
Ga MP	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.59	0.28	0.57
Hg TP	0.844 159 29	0.04	303	0.844 160 13	0.23	14	-0.21	0.24	0.51
Ar TP	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	0.24	0.29	0.66

Table 11. Differences in realization of ITS-90 between Laboratory X and NIM (continued). dir. means direct and inc. means inclusive.

dir.	NML			NIM			NML-NIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 671 26	0.43	215	3.375 663 92	1.39	13	2.29	1.46	3.13
Zn FP	2.568 701 29	0.21	267	2.568 704 79	0.56	21	-1.00	0.60	1.23
Cd FP	2.218 974 91	0.18	236	2.218 985 09	0.86	9	-2.83	0.88	1.99
Sn FP	1.892 676 09	0.15	207	1.892 676 88	1.59	3	-0.21	1.60	5.66
In FP	1.609 716 06	0.41	181	1.609 718 33	0.46	28	-0.60	0.62	1.24
Ga MP	1.118 123 46	0.13	186	1.118 122 28	0.28	36	0.30	0.31	0.62
Hg TP	0.844 158 14	0.13	182	0.844 160 13	0.23	14	-0.50	0.26	0.56
Ar TP	0.215 941 86	0.49	120	0.215 952 54	0.28	8	-2.46	0.56	1.17

inc.	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			NIM			NML-NIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 663 92	1.39	13	2.29	1.46	3.13
Zn FP	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-0.92	0.60	1.24
Cd FP	2.218 980 47	0.07	55	2.218 985 09	0.86	9	-2.49	0.89	2.00
Sn FP	1.892 681 25	0.06	372	1.892 676 88	1.59	3	0.04	1.60	5.66
In FP	1.609 724 44	0.04	877	1.609 718 33	0.46	28	-0.04	0.62	1.25
Ga MP	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.43	0.31	0.63
Hg TP	0.844 159 29	0.04	303	0.844 160 13	0.23	14	-0.26	0.27	0.56
Ar TP	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	-2.18	0.57	1.17

Table 11. Differences in realization of ITS-90 between Laboratory X and NIM (continued). dir. means direct and inc. means inclusive.

dir & inc	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			NIM			NPL-NIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 663 92	1.39	13	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-0.47	0.72	1.47
Cd FP	2.218 980 47	0.07	55	2.218 985 09	0.86	9	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 676 88	1.59	3	0.91	1.63	5.70
In FP	1.609 724 44	0.04	877	1.609 718 33	0.46	28	0.92	0.57	1.15
Ga MP	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.43	0.35	0.71
Hg TP	0.844 159 29	0.04	303	0.844 160 13	0.23	14	-0.10	0.30	0.63
Ar TP	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	-0.77	0.45	0.95

dir & inc	NRC			NIST			NIST			NIM			NRC-NIM		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686	3.375 674 05	0.21	686	3.375 663 92	1.39	13	5.08	1.50	3.22
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-1.48	0.60	1.31
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55	2.218 980 47	0.07	55	2.218 985 09	0.86	9	-2.24	0.89	2.01
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372	1.892 681 25	0.06	372	1.892 676 88	1.59	3	-0.17	1.64	5.70
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877	1.609 724 44	0.04	877	1.609 718 33	0.46	28	0.58	0.48	0.99
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.45	0.31	0.63
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303	0.844 159 29	0.04	303	0.844 160 13	0.23	14	0.01	0.25	0.53
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	0.34	0.32	0.73

Table 11. Differences in realization of ITS-90 between Laboratory X and NIM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir.	NRLM			NML			NML			NIM			NRLM-NIM		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240	3.375 671 26	0.43	215	3.375 663 92	1.39	13	1.51	2.19	4.60
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344	2.568 701 29	0.21	267	2.568 704 79	0.56	21	-2.85	1.18	2.37
Cd FP	NA	NA	NA	2.218 939 38	0.20	305	2.218 974 91	0.18	236	2.218 985 09	0.86	9	NA	NA	NA
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245	1.892 676 09	0.15	207	1.892 676 88	1.59	3	-0.27	1.65	5.71
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183	1.609 716 06	0.41	181	1.609 718 33	0.46	28	0.05	0.65	1.34
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194	1.118 123 46	0.13	186	1.118 122 28	0.28	36	0.09	0.30	0.61
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186	0.844 158 14	0.13	182	0.844 160 13	0.23	14	-0.55	0.38	0.77
Ar TP	NA	NA	NA	NA	NA	NA	0.215 941 86	0.49	120	0.215 952 54	0.28	8	NA	NA	NA

Table 11. Differences in realization of ITS-90 between Laboratory X and NIM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

inc	NRLM			NML		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			NIM			NRLM-NIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 663 92	1.39	13	1.51	2.19	4.60
Zn FP	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-2.77	1.18	2.37
Cd FP	2.218 980 47	0.07	55	2.218 985 09	0.86	9	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 676 88	1.59	3	-0.02	1.65	5.72
In FP	1.609 724 44	0.04	877	1.609 718 33	0.46	28	0.61	0.65	1.34
Ga MP	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.22	0.30	0.61
Hg TP	0.844 159 29	0.04	303	0.844 160 13	0.23	14	-0.31	0.38	0.77
Ar TP	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	NA	NA	NA

Table 11. Differences in realization of ITS-90 between Laboratory X and NIM (continued). dir. means direct and inc. means inclusive.

dir & inc	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST			NIM			PTB-NIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 663 92	1.39	13	4.20	1.64	3.46
Zn FP	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-1.52	0.86	1.74
Cd FP	2.218 980 47	0.07	55	2.218 985 09	0.86	9	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 676 88	1.59	3	1.38	1.65	5.72
In FP	1.609 724 44	0.04	877	1.609 718 33	0.46	28	1.30	0.73	1.46
Ga MP	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.80	0.31	0.62
Hg TP	0.844 159 29	0.04	303	0.844 160 13	0.23	14	-0.26	0.28	0.58
Ar TP	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	0.01	0.40	0.86

Table 11. Differences in realization of ITS-90 between Laboratory X and NIM (continued). dir. means direct and inc. means inclusive.

dir & inc	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			NIM			SMU-NIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 663 92	1.39	13	4.30	1.47	3.17
Zn FP	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-0.81	0.69	1.42
Cd FP	2.218 980 47	0.07	55	2.218 985 09	0.86	9	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 676 88	1.59	3	1.05	1.65	5.72
In FP	1.609 724 44	0.04	877	1.609 718 33	0.46	28	NA	NA	NA
Ga MP	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.63	0.30	0.60
Hg TP	0.844 159 29	0.04	303	0.844 160 13	0.23	14	NA	NA	NA
Ar TP	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	NA	NA	NA

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dir & inc	VNIIM			NIST			NIST			NIM			VNIIM-NIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686	3.375 674 05	0.21	686	3.375 663 92	1.39	13	2.86	1.51	3.35
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-0.31	0.79	1.84
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55	2.218 980 47	0.07	55	2.218 985 09	0.86	9	-0.89	1.02	2.44
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372	1.892 681 25	0.06	372	1.892 676 88	1.59	3	1.38	1.62	5.70
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877	1.609 724 44	0.04	877	1.609 718 33	0.46	28	1.72	0.55	1.18
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.60	0.29	0.60
Hg TP	NA	NA	NA	0.844 157 56	0.04	303	0.844 159 29	0.04	303	0.844 160 13	0.23	14	NA	NA	NA
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	NA	NA	NA

Table 11. Differences in realization of ITS-90 between Laboratory X and NIM (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST			NIST			NIM			VSL-NIM		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686	3.375 674 05	0.21	686	3.375 663 92	1.39	13	2.75	1.61	3.41
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022	2.568 703 63	0.13	2022	2.568 704 79	0.56	21	-0.64	0.75	1.52
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55	2.218 980 47	0.07	55	2.218 985 09	0.86	9	-2.42	NA	NA
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372	1.892 681 25	0.06	372	1.892 676 88	1.59	3	0.75	1.63	5.70
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877	1.609 724 44	0.04	877	1.609 718 33	0.46	28	0.39	0.56	1.15
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148	1.118 124 62	0.01	1148	1.118 122 28	0.28	36	0.37	0.35	0.70
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303	0.844 159 29	0.04	303	0.844 160 13	0.23	14	-0.17	0.31	0.65
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625	0.215 953 56	0.03	6625	0.215 952 54	0.28	8	0.18	0.44	0.93

Table 12. Differences in realization of ITS-90 between Laboratory X and NIST. dir. means direct and inc. means inclusive.

dir & inc	BIPM						NIST						BIPM-NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	NA	NA	NA
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335	NA	NA	NA
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	-0.09	0.08	0.16
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA

dir & inc	BNM/INM						NIST						BNM/INM-NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506	2.33	1.14	2.25
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	-0.01	0.51	1.01
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49	NA	NA	NA
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353	-0.50	0.48	0.94
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599	-0.63	0.33	0.64
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	-0.03	0.15	0.29
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292	-0.37	0.29	0.57
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	-0.35	0.29	0.58

dir & inc	IMGC			NIST			IMGC-NIST		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353	-2.36	0.55	1.10
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059	-1.30	0.45	0.91
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44	-1.47	0.33	0.66
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335	-0.13	0.23	0.44
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375	-0.26	0.32	0.63
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646	0.09	0.06	0.13
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281	-0.09	0.14	0.27
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385	0.73	0.23	0.52

Table 12. Differences in realization of ITS-90 between Laboratory X and NIST (continued). dir. means direct and inc. means inclusive.

dir & inc	KRISS			NIST			KRISS-NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686	-3.88	1.13	2.54
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022	-1.04	0.64	1.36
Cd FP	NA	NA	NA	2.218 980 47	0.07	55	NA	NA	NA
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372	-0.53	0.46	1.03
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877	1.33	0.38	0.75
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148	0.00	0.20	0.46
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303	0.50	0.21	0.47
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625	NA	NA	NA

dir & inc	MSL			NIST			MSL-NIST		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	3.375 711 84	0.21	686	NA	NA	NA
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022	-0.75	1.01	5.43
Cd FP	NA	NA	NA	2.219 014 25	0.07	55	NA	NA	NA
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372	-0.84	0.49	1.18
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877	-0.40	0.40	0.85
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148	0.17	0.18	0.36
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303	0.26	0.20	0.41
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625	NA	NA	NA

dir & inc	NIM			NIST			NIM-NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686	-3.16	1.41	3.04
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022	0.33	0.58	1.19
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55	1.28	0.87	1.96
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372	-1.18	1.59	5.65
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877	-1.61	0.46	0.94
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148	-0.59	0.28	0.57
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303	0.21	0.24	0.51
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625	-0.24	0.29	0.66

Table 12. Differences in realization of ITS-90 between Laboratory X and NIST (continued). dir. means direct and inc. means inclusive.

dir & inc	NML						NIST						NML-NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686	-0.87	0.48	0.95
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	-0.59	0.24	0.46
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55	-1.21	0.20	0.41
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372	-1.14	0.17	0.36
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877	-1.65	0.42	0.82
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	-0.16	0.13	0.26
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303	-0.05	0.13	0.25
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	-2.42	0.49	0.97

dir & inc	NPL						NIST						NPL-NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	W (T_{90}) s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	-0.14	0.46	0.90
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335	-0.27	0.36	0.72
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375	-0.68	0.34	0.67
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	-0.17	0.21	0.42
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.11	0.19	0.37
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	-1.01	0.35	0.68

dir & inc	NRC			NIST			NRC-NIST		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686	1.93	0.57	1.13
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022	-1.15	0.23	0.61
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55	-0.95	0.21	0.42
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372	-1.35	0.39	0.76
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877	-1.03	0.16	0.32
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148	-0.14	0.13	0.27
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303	0.22	0.08	0.17
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625	0.10	0.16	0.31

Table 12. Differences in realization of ITS-90 between Laboratory X and NIST (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	NRLM			NML		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						NIST						NRLM-NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686	-1.64	1.70	3.50
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	-2.44	1.04	2.08
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55	NA	NA	NA
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372	-1.20	0.44	0.88
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877	-1.00	0.46	0.96
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	-0.37	0.11	0.22
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303	-0.10	0.30	0.59
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	NA	NA	NA

Table 12. Differences in realization of ITS-90 between Laboratory X and NIST (continued). dir. means direct and inc. means inclusive.

dir & inc	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST									PTB-NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353	1.04	0.87	1.71
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059	-1.19	0.66	1.29
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335	0.20	0.44	0.86
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375	-0.31	0.57	1.12
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646	0.20	0.12	0.24
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281	-0.05	0.14	0.28
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385	-0.23	0.28	0.55

dir & inc	SMU						NIST						SMU-NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353	1.14	0.48	0.99
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	-0.47	0.41	0.82
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335	-0.13	0.44	0.86
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	0.04	0.10	0.19
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA

Table 12. Differences in realization of ITS-90 between Laboratory X and NIST (continued). dir. means direct and inc. means inclusive.

dir & inc	VNIIM			NIST			VNIIM-NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686	-0.29	0.58	1.47
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022	0.02	0.55	1.43
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55	0.40	0.54	1.46
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372	0.20	0.28	0.71
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877	0.11	0.30	0.72
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148	0.01	0.08	0.19
Hg TP	NA	NA	NA	0.844 157 56	0.04	303	NA	NA	NA
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625	NA	NA	NA

dir & inc	VSL			NIST			VSL-NIST		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686	-0.41	0.80	1.59
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022	-0.31	0.50	0.98
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55	-1.14	NA	NA
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372	-0.43	0.38	0.74
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877	-1.22	0.33	0.67
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148	-0.23	0.21	0.41
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303	0.04	0.21	0.41
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625	-0.06	0.33	0.66

Table 13. Differences in realization of ITS-90 between Laboratory X and NML. dir. means direct and inc. means inclusive.

dir & inc	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST						NML						BIPM-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	NA	NA	NA
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	NA	NA	NA
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	NA	NA	NA
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.07	0.15	0.30
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	NA	NA	NA
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	NA	NA	NA

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). dir. means direct and inc. means inclusive.

dir & inc	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST						NML						BNM/INM-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	3.20	1.22	2.40
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	0.57	0.54	1.07
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	0.64	0.51	1.00
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.01	0.53	1.04
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.14	0.20	0.39
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	-0.32	0.32	0.62
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	2.07	0.57	1.12

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). dir. means direct and inc. means inclusive.

dir & inc	IMGC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385

	NIST						NML						IMGC-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	-1.49	0.70	1.38
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	-0.72	0.49	0.98
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	-0.26	0.39	0.77
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.01	0.28	0.57
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.39	0.52	1.03
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.25	0.14	0.29
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	-0.04	0.19	0.37
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	3.15	0.54	1.10

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dir.	KRISS			NML			KRISS-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 661 60	1.11	9	3.375 671 26	0.43	215	-3.01	1.19	2.65
Zn FP	2.568 700 00	0.63	15	2.568 701 29	0.21	267	-0.37	0.66	1.40
Cd FP	NA	NA	NA	2.218 974 91	0.18	236	NA	NA	NA
Sn FP	1.892 679 30	0.46	10	1.892 676 09	0.15	207	0.86	0.49	1.06
In FP	1.609 729 50	0.38	112	1.609 716 06	0.41	181	3.54	0.56	1.11
Ga MP	1.118 124 60	0.20	10	1.118 123 46	0.13	186	0.29	0.24	0.52
Hg TP	0.844 161 30	0.21	11	0.844 158 14	0.13	182	0.79	0.24	0.52
Ar TP	NA	NA	NA	0.215 941 86	0.49	120	NA	NA	NA

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). dir. means direct and inc. means inclusive.

inc.	KRISS			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022
Cd FP	NA	NA	NA	2.218 980 47	0.07	55
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625

	NIST						NML						KRISS-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	-3.01	1.19	2.65
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	-0.45	0.66	1.40
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	0.61	0.49	1.08
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	2.98	0.56	1.11
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.16	0.24	0.52
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.55	0.24	0.53
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	NA	NA	NA

dir.	MSL			NML			MSL-NML		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 740 53	1.01	2	2.568 741 40	0.24	344	-0.25	1.03	5.44
Cd FP	NA	NA	NA	2.219 011 08	0.20	305	NA	NA	NA
Sn FP	1.892 703 74	0.47	6	1.892 703 57	0.16	245	0.05	0.51	1.22
In FP	1.609 739 76	0.39	14	1.609 737 15	0.42	183	0.69	0.58	1.18
Ga MP	1.118 128 26	0.18	1155135	1.118 127 46	0.13	194	0.20	0.22	0.44
Hg TP	0.844 152 71	0.19	21	0.844 152 43	0.13	191	0.07	0.23	0.47
Ar TP	NA	NA	NA	0.215 904 58	0.49	120	NA	NA	NA

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). dir. means direct and inc. means inclusive.

inc.	MSL			NIST		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	NA	NA	NA	3.375 711 84	0.21	686
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022
Cd FP	NA	NA	NA	2.219 014 25	0.07	55
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625

	NIST						NML						MSL-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	-0.17	1.03	5.44
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	0.30	0.51	1.23
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.25	0.58	1.18
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.33	0.22	0.44
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.31	0.23	0.47
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	NA	NA	NA

dir.	NIM			NML			NIM-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 663 92	1.39	13	3.375 671 26	0.43	215	-2.29	1.46	3.13
Zn FP	2.568 704 79	0.56	21	2.568 701 29	0.21	267	1.00	0.60	1.23
Cd FP	2.218 985 09	0.86	9	2.218 974 91	0.18	236	2.83	0.88	1.99
Sn FP	1.892 676 88	1.59	3	1.892 676 09	0.15	207	0.21	1.60	5.66
In FP	1.609 718 33	0.46	28	1.609 716 06	0.41	181	0.60	0.62	1.24
Ga MP	1.118 122 28	0.28	36	1.118 123 46	0.13	186	-0.30	0.31	0.62
Hg TP	0.844 160 13	0.23	14	0.844 158 14	0.13	182	0.50	0.26	0.56
Ar TP	0.215 952 54	0.28	8	0.215 941 86	0.49	120	2.46	0.56	1.17

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). dir. means direct and inc. means inclusive.

inc.	NIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625

	NIST						NML						NIM-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	-2.29	1.46	3.13
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	0.92	0.60	1.24
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.49	0.89	2.00
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	-0.04	1.60	5.66
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	0.04	0.62	1.25
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	-0.43	0.31	0.63
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.26	0.27	0.56
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	2.18	0.57	1.17

dir & inc	NIST						NML						NIST-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	0.87	0.48	0.95
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	0.59	0.24	0.46
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	1.21	0.20	0.41
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.14	0.17	0.36
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.65	0.42	0.82
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.16	0.13	0.26
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.05	0.13	0.25
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	2.42	0.49	0.97

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). dir. means direct and inc. means inclusive.

dir & inc	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST						NML						NPL-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	0.45	0.49	0.98
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	0.87	0.40	0.80
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	0.96	0.54	1.06
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.00	0.25	0.49
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.15	0.23	0.45
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	1.41	0.60	1.18

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	NRC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625

	NIST						NML						NRC-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	2.80	0.71	1.41
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	-0.57	0.30	0.71
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	0.26	0.28	0.58
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	-0.21	0.42	0.84
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	0.62	0.44	0.88
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.02	0.18	0.37
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.26	0.15	0.30
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	2.52	0.51	1.01

dir & inc	NRLM			NML			NRLM-NML		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240	-0.77	1.71	3.50
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344	-1.85	1.05	2.09
Cd FP	NA	NA	NA	2.218 939 38	0.20	305	NA	NA	NA
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245	-0.06	0.45	0.90
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183	0.65	0.62	1.26
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194	-0.21	0.17	0.33
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186	-0.06	0.32	0.63
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). dir. means direct and inc. means inclusive.

dir & inc	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST						NML						PTB-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	1.91	0.97	1.90
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	-0.60	0.68	1.35
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.34	0.47	0.93
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.34	0.70	1.38
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.37	0.18	0.35
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	-0.01	0.19	0.38
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	2.19	0.56	1.11

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). dir. means direct and inc. means inclusive.

dir & inc	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST						NML						SMU-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	2.01	0.64	1.30
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	0.11	0.45	0.90
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	NA	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.01	0.47	0.93
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	NA	NA	NA
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.20	0.16	0.32
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	NA	NA	NA
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	NA	NA	NA

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). dir. means direct and inc. means inclusive.

dir & inc	VNIIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148
Hg TP	NA	NA	NA	0.844 157 56	0.04	303
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625

	NIST						NML						VNIIM-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	0.57	0.72	1.69
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	0.61	0.59	1.48
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	1.61	0.58	1.51
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.34	0.33	0.79
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.76	0.51	1.09
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	0.17	0.15	0.32
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	NA	NA	NA
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	NA	NA	NA

Table 13. Differences in realization of ITS-90 between Laboratory X and NML (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c $(k=1)$	DF	$W(T_{90})$ s/n 1094	u_c $(k=1)$	DF
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625

	NIST						NML						VSL-NML		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c $(k=1)$	DF	$W(T_{90})$ s/n 1032	u_c $(k=1)$	DF	$W(T_{90})$ s/n 4386	u_c $(k=1)$	DF	$W(T_{90})$ s/n 1032	u_c $(k=1)$	DF	dir & inc ΔT, mK	u_c $(k=1)$	U (95%)
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA	0.46	0.91	1.80
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344	0.28	0.53	1.05
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305	0.07	NA	NA
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245	0.71	0.41	0.82
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183	0.43	0.53	1.06
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194	-0.06	0.25	0.48
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.09	0.24	0.48
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120	2.36	0.59	1.17

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL. dir. means direct and inc. means inclusive.

dir & inc	BIPM						NPL						BIPM-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	NA	NA	NA	NA	NA	NA	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	NA	NA	NA
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	NA	NA	NA	NA	NA	NA	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	NA	NA	NA
In FP	NA	NA	NA	NA	NA	NA	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	NA	NA	NA
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.08	0.23	0.45
Hg TP	NA	NA	NA	NA	NA	NA	0.844 158 45	0.20	131	0.844 151 15	0.20	131	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	0.215 943 20	0.36	126	0.215 903 23	0.35	251	NA	NA	NA

dir.	BNM/INM			NPL			BNM/INM-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 693 08	1.12	711852	NA	NA	NA	NA	NA	NA
Zn FP	2.568 719 35	0.52	75	2.568 719 60	0.44	7969	-0.07	0.68	1.35
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 51	0.48	468	1.892 683 05	0.36	1921	0.66	0.61	1.19
In FP	1.609 724 31	0.32	2205	1.609 722 05	0.34	1543	0.59	0.48	0.93
Ga MP	1.118 123 65	0.15	8611	1.118 123 10	0.22	50	0.14	0.27	0.54
Hg TP	0.844 156 18	0.29	5581	0.844 158 45	0.20	131	-0.57	0.35	0.69
Ar TP	0.215 947 01	0.31	156	0.215 943 20	0.36	126	0.88	0.48	0.94

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

inc.	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST						NPL						BNM/INM-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	0.13	0.66	1.32
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	-0.23	0.60	1.18
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	0.05	0.47	0.92
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.14	0.26	0.51
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	-0.48	0.34	0.68
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.66	0.45	0.89

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

dir & inc	IMGC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385

	NIST						NPL						IMGC-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	-1.16	0.63	1.25
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	0.14	0.43	0.84
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	0.42	0.46	0.91
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.25	0.22	0.44
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	-0.19	0.23	0.46
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	1.74	0.41	0.85

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

dir & inc	KRISS			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022
Cd FP	NA	NA	NA	2.218 980 47	0.07	55
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625

	NIST						NPL						KRISS-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	-0.90	0.77	1.61
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	-0.26	0.59	1.25
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	2.02	0.51	1.00
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.16	0.29	0.62
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.40	0.28	0.60
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	NA	NA	NA

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

dir & inc	MSL			NIST		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c $(k=1)$	DF	$W(T_{90})$ s/n 1032	u_c $(k=1)$	DF
Al FP	NA	NA	NA	3.375 711 84	0.21	686
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022
Cd FP	NA	NA	NA	2.219 014 25	0.07	55
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625

	NIST						NPL						MSL-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c $(k=1)$	DF	$W(T_{90})$ s/n 1030B	u_c $(k=1)$	DF	$W(T_{90})$ s/n 4385	u_c $(k=1)$	DF	$W(T_{90})$ s/n 1030B	u_c $(k=1)$	DF	dir & inc ΔT, mK	u_c $(k=1)$	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	-0.61	1.10	5.49
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	-0.57	0.61	1.38
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	0.28	0.52	1.08
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.34	0.28	0.55
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.16	0.27	0.55
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	NA	NA	NA

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

dir & inc	NIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 4386	u_c $(k=1)$	*DF*
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625

	NIST						NPL						NIM-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 1030B	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 4385	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 1030B	u_c $(k=1)$	*DF*	dir & inc ΔT, mK	u_c $(k=1)$	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	0.47	0.72	1.47
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	-0.91	1.63	5.70
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	-0.92	0.57	1.15
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	-0.43	0.35	0.71
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.10	0.30	0.63
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.77	0.45	0.95

dir & inc	NIST						NPL						NIST-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 1030B	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 4385	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 1030B	u_c $(k=1)$	*DF*	dir & inc ΔT, mK	u_c $(k=1)$	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	0.14	0.46	0.90
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	0.27	0.36	0.72
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	0.68	0.34	0.67
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.17	0.21	0.42
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	-0.11	0.19	0.37
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	1.01	0.35	0.68

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

dir & inc	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST						NPL						NML-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	-0.45	0.49	0.98
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	-0.87	0.40	0.80
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	-0.96	0.54	1.06
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.00	0.25	0.49
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	-0.15	0.23	0.45
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	-1.41	0.60	1.18

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

dir & inc	NRC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625

	NIST						NPL						NRC-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	-1.01	0.49	1.05
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	-1.08	0.53	1.05
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	-0.35	0.37	0.74
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.03	0.25	0.50
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.11	0.21	0.41
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	1.11	0.38	0.74

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	**NRLM**			**NML**		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						**NIST**					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST						**NPL**						**NRLM-NPL**		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	-2.29	1.13	2.25
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	-0.93	0.57	1.13
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	-0.32	0.57	1.17
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	-0.21	0.24	0.48
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	-0.21	0.35	0.69
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	NA	NA	NA

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

dir.	PTB						NPL						PTB-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 692 83	0.84	48985	3.375 761 10	0.88	3670	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 714 64	0.64	1261745	2.568 764 20	0.66	54953	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	-0.47	0.78	1.53
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 718 80	0.46	12660	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	0.60	0.57	1.11
In FP	1.609 723 74	0.57	79186	1.609 747 50	0.59	3829	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	0.20	0.66	1.30
Ga MP	1.118 124 16	0.12	176720	1.118 129 70	0.13	9094	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.31	0.25	0.48
Hg TP	0.844 157 80	0.14	79186	0.844 149 90	0.15	3829	0.844 158 45	0.20	131	0.844 151 15	0.20	131	-0.24	0.24	0.46
Ar TP	0.215 945 82	0.28	14496	0.215 907 60	0.31	881	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.80	0.45	0.87

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

inc.	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST						NPL						PTB-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	-1.04	0.78	1.54
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	0.47	0.57	1.11
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	0.37	0.66	1.30
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.37	0.24	0.48
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	-0.16	0.24	0.46
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.78	0.44	0.87

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

dir & inc	SMU						NPL						SMU-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	-0.33	0.58	1.16
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	0.14	0.56	1.10
In FP	NA	NA	NA	NA	NA	NA	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	NA	NA	NA
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.21	0.23	0.46
Hg TP	NA	NA	NA	NA	NA	NA	0.844 158 45	0.20	131	0.844 151 15	0.20	131	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	0.215 943 20	0.36	126	0.215 903 23	0.35	251	NA	NA	NA

dir.	VNIIM			NPL			VNIIM-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 678 20	0.54	5	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 20	0.54	5	2.568 719 60	0.44	7969	-2.69	0.69	1.65
Cd FP	2.218 988 54	0.53	4	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 50	0.28	5	1.892 683 05	0.36	1921	0.93	0.46	1.00
In FP	1.609 728 36	0.29	6	1.609 722 05	0.34	1543	1.66	0.45	0.98
Ga MP	1.118 125 03	0.08	8	1.118 123 10	0.22	50	0.49	0.24	0.49
Hg TP	NA	NA	NA	0.844 158 45	0.20	131	NA	NA	NA
Ar TP	NA	NA	NA	0.215 943 20	0.36	126	NA	NA	NA

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

inc.	VNIIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148
Hg TP	NA	NA	NA	0.844 157 56	0.04	303
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625

	NIST						NPL						VNIIM-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	0.17	0.70	1.66
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	0.47	0.46	1.00
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	0.80	0.45	0.98
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	0.18	0.23	0.46
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	NA	NA	NA

Table 14. Differences in realization of ITS-90 between Laboratory X and NPL (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625

	NIST						NPL						VSL-NPL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	-0.17	0.66	1.31
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	-0.16	0.52	1.03
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	-0.53	0.47	0.94
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 123 10	0.22	50	1.118 128 30	0.22	50	-0.06	0.30	0.59
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	0.844 158 45	0.20	131	0.844 151 15	0.20	131	-0.06	0.28	0.55
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.95	0.48	0.94

Table 15. Differences in realization of ITS-90 between Laboratory X and NRC. dir. means direct and inc. means inclusive.

dir & inc	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			NRC			BIPM-NRC		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U(95%)
Al FP	3.375 747 12	0.21	686	3.375 753 30	0.53	77	NA	NA	NA
Zn FP	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	NA	NA	NA
Cd FP	2.219 023 55	0.07	55	2.219 020 11	0.19	25	NA	NA	NA
Sn FP	1.892 712 69	0.06	372	1.892 707 68	0.38	232	NA	NA	NA
In FP	1.609 745 17	0.04	877	1.609 741 25	0.13	27	NA	NA	NA
Ga MP	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	0.05	0.15	0.31
Hg TP	0.844 151 59	0.04	303	0.844 152 46	0.08	33	NA	NA	NA
Ar TP	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	NA	NA	NA

Table 15. Differences in realization of ITS-90 between Laboratory X and NRC (continued). dir. means direct and inc. means inclusive.

dir & inc	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST			NRC			BNM/INM-NRC		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	DF	$W(T_{90})$ s/n 1098A	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 12	0.21	686	3.375 753 30	0.53	77	0.41	1.26	2.48
Zn FP	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	1.14	0.54	1.14
Cd FP	2.219 023 55	0.07	55	2.219 020 11	0.19	25	NA	NA	NA
Sn FP	1.892 712 69	0.06	372	1.892 707 68	0.38	232	0.85	0.61	1.21
In FP	1.609 745 17	0.04	877	1.609 741 25	0.13	27	0.40	0.36	0.71
Ga MP	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	0.11	0.19	0.40
Hg TP	0.844 151 59	0.04	303	0.844 152 46	0.08	33	-0.59	0.30	0.59
Ar TP	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	-0.45	0.33	0.65

dir & inc	IMGC			NIST			NIST			NRC			IMGC-NRC		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	DF	$W(T_{90})$ s/n 1098B	u_c (k=1)	DF	$W(T_{90})$ s/n 1098A	u_c (k=1)	DF	$W(T_{90})$ s/n 1098A	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353	3.375 747 12	0.21	686	3.375 753 30	0.53	77	-4.29	0.75	1.49
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	-0.15	0.48	1.04
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44	2.219 023 55	0.07	55	2.219 020 11	0.19	25	-0.51	0.38	0.77
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335	1.892 712 69	0.06	372	1.892 707 68	0.38	232	1.22	0.44	0.88
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375	1.609 745 17	0.04	877	1.609 741 25	0.13	27	0.77	0.35	0.70
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	0.23	0.14	0.30
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281	0.844 151 59	0.04	303	0.844 152 46	0.08	33	-0.30	0.16	0.31
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	0.63	0.28	0.60

Table 15. Differences in realization of ITS-90 between Laboratory X and NRC (continued). dir. means direct and inc. means inclusive.

dir & inc	KRISS			NIST			NIST			NRC			KRISS-NRC		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686	3.375 747 12	0.21	686	3.375 753 30	0.53	77	-5.81	1.25	2.75
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	0.12	0.67	1.47
Cd FP	NA	NA	NA	2.218 980 47	0.07	55	2.219 023 55	0.07	55	2.219 020 11	0.19	25	NA	NA	NA
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372	1.892 712 69	0.06	372	1.892 707 68	0.38	232	0.82	0.60	1.28
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877	1.609 745 17	0.04	877	1.609 741 25	0.13	27	2.36	0.41	0.81
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	0.13	0.24	0.53
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303	0.844 151 59	0.04	303	0.844 152 46	0.08	33	0.28	0.23	0.50
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	NA	NA	NA

dir & inc	MSL			NIST			NIST			NRC			MSL-NRC		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	3.375 711 84	0.21	686	3.375 747 12	0.21	686	3.375 753 30	0.53	77	NA	NA	NA
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	0.40	1.03	5.45
Cd FP	NA	NA	NA	2.219 014 25	0.07	55	2.219 023 55	0.07	55	2.219 020 11	0.19	25	NA	NA	NA
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372	1.892 712 69	0.06	372	1.892 707 68	0.38	232	0.51	0.62	1.41
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877	1.609 745 17	0.04	877	1.609 741 25	0.13	27	0.63	0.43	0.91
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	0.31	0.22	0.45
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303	0.844 151 59	0.04	303	0.844 152 46	0.08	33	0.05	0.21	0.44
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	NA	NA	NA

dir & inc	NIM			NIST			NIST			NRC			NIM-NRC		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686	3.375 747 12	0.21	686	3.375 753 30	0.53	77	-5.08	1.50	3.22
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	1.48	0.60	1.31
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55	2.219 023 55	0.07	55	2.219 020 11	0.19	25	2.24	0.89	2.01
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372	1.892 712 69	0.06	372	1.892 707 68	0.38	232	0.17	1.64	5.70
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877	1.609 745 17	0.04	877	1.609 741 25	0.13	27	-0.58	0.48	0.99
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	-0.45	0.31	0.63
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303	0.844 151 59	0.04	303	0.844 152 46	0.08	33	-0.01	0.25	0.53
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	-0.34	0.32	0.73

Table 15. Differences in realization of ITS-90 between Laboratory X and NRC (continued). dir. means direct and inc. means inclusive.

dir & inc	NIST			NRC			NIST-NRC		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 12	0.21	686	3.375 753 30	0.53	77	-1.93	0.57	1.13
Zn FP	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	1.15	0.23	0.61
Cd FP	2.219 023 55	0.07	55	2.219 020 11	0.19	25	0.95	0.21	0.42
Sn FP	1.892 712 69	0.06	372	1.892 707 68	0.38	232	1.35	0.39	0.76
In FP	1.609 745 17	0.04	877	1.609 741 25	0.13	27	1.03	0.16	0.32
Ga MP	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	0.14	0.13	0.27
Hg TP	0.844 151 59	0.04	303	0.844 152 46	0.08	33	-0.22	0.08	0.17
Ar TP	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	-0.10	0.16	0.31

dir & inc	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			NRC			NML-NRC		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 12	0.21	686	3.375 753 30	0.53	77	-2.80	0.71	1.41
Zn FP	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	0.57	0.30	0.71
Cd FP	2.219 023 55	0.07	55	2.219 020 11	0.19	25	-0.26	0.28	0.58
Sn FP	1.892 712 69	0.06	372	1.892 707 68	0.38	232	0.21	0.42	0.84
In FP	1.609 745 17	0.04	877	1.609 741 25	0.13	27	-0.62	0.44	0.88
Ga MP	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	-0.02	0.18	0.37
Hg TP	0.844 151 59	0.04	303	0.844 152 46	0.08	33	-0.26	0.15	0.30
Ar TP	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	-2.52	0.51	1.01

Table 15. Differences in realization of ITS-90 between Laboratory X and NRC (continued). dir. means direct and inc. means inclusive.

dir & inc	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			NRC			NPL-NRC		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 12	0.21	686	3.375 753 30	0.53	77	NA	NA	NA
Zn FP	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	1.01	0.49	1.05
Cd FP	2.219 023 55	0.07	55	2.219 020 11	0.19	25	NA	NA	NA
Sn FP	1.892 712 69	0.06	372	1.892 707 68	0.38	232	1.08	0.53	1.05
In FP	1.609 745 17	0.04	877	1.609 741 25	0.13	27	0.35	0.37	0.74
Ga MP	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	-0.03	0.25	0.50
Hg TP	0.844 151 59	0.04	303	0.844 152 46	0.08	33	-0.11	0.21	0.41
Ar TP	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	-1.11	0.38	0.74

Table 15. Differences in realization of ITS-90 between Laboratory X and NRC (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	NRLM			NML		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			NRC			NRLM-NRC		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 747 12	0.21	686	3.375 753 30	0.53	77	-3.57	1.78	3.65
Zn FP	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	-1.28	1.06	2.15
Cd FP	2.219 023 55	0.07	55	2.219 020 11	0.19	25	NA	NA	NA
Sn FP	1.892 712 69	0.06	372	1.892 707 68	0.38	232	0.15	0.58	1.16
In FP	1.609 745 17	0.04	877	1.609 741 25	0.13	27	0.03	0.49	1.01
Ga MP	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	-0.23	0.17	0.35
Hg TP	0.844 151 59	0.04	303	0.844 152 46	0.08	33	-0.32	0.31	0.61
Ar TP	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	NA	NA	NA

Table 15. Differences in realization of ITS-90 between Laboratory X and NRC (continued). dir. means direct and inc. means inclusive.

dir & inc	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST			NRC			PTB-NRC		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U(95%)
Al FP	3.375 747 12	0.21	686	3.375 753 30	0.53	77	-0.88	1.01	2.00
Zn FP	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	-0.03	0.68	1.40
Cd FP	2.219 023 55	0.07	55	2.219 020 11	0.19	25	NA	NA	NA
Sn FP	1.892 712 69	0.06	372	1.892 707 68	0.38	232	1.55	0.59	1.15
In FP	1.609 745 17	0.04	877	1.609 741 25	0.13	27	0.72	0.59	1.16
Ga MP	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	0.34	0.18	0.36
Hg TP	0.844 151 59	0.04	303	0.844 152 46	0.08	33	-0.27	0.17	0.33
Ar TP	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	-0.33	0.32	0.62

Table 15. Differences in realization of ITS-90 between Laboratory X and NRC (continued). dir. means direct and inc. means inclusive.

dir & inc	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 1030B	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 4385	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 1030B	u_c $(k=1)$	*DF*
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			NRC			SMU-NRC		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 1098A	u_c $(k=1)$	*DF*	dir & inc ΔT, mK	u_c $(k=1)$	U (95%)
Al FP	3.375 747 12	0.21	686	3.375 753 30	0.53	77	-0.78	0.71	1.44
Zn FP	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	0.68	0.45	0.98
Cd FP	2.219 023 55	0.07	55	2.219 020 11	0.19	25	NA	NA	NA
Sn FP	1.892 712 69	0.06	372	1.892 707 68	0.38	232	1.22	0.58	1.15
In FP	1.609 745 17	0.04	877	1.609 741 25	0.13	27	NA	NA	NA
Ga MP	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	0.18	0.16	0.33
Hg TP	0.844 151 59	0.04	303	0.844 152 46	0.08	33	NA	NA	NA
Ar TP	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	NA	NA	NA

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dir & inc	VNIIM			NIST			NIST			NRC			VNIIM-NRC		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 4385	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 1098A	u_c $(k=1)$	*DF*	$W(T_{90})$ s/n 1098A	u_c $(k=1)$	*DF*	dir & inc ΔT, mK	u_c $(k=1)$	U (95%)
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686	3.375 747 12	0.21	686	3.375 753 30	0.53	77	-2.22	0.78	1.80
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	1.18	0.58	1.53
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55	2.219 023 55	0.07	55	2.219 020 11	0.19	25	1.35	0.58	1.51
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372	1.892 712 69	0.06	372	1.892 707 68	0.38	232	1.55	0.48	1.04
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877	1.609 745 17	0.04	877	1.609 741 25	0.13	27	1.15	0.33	0.78
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	0.15	0.15	0.32
Hg TP	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 59	0.04	303	0.844 152 46	0.08	33	NA	NA	NA
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	NA	NA	NA

Table 15. Differences in realization of ITS-90 between Laboratory X and NRC (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST			NIST			NRC			VSL-NRC		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686	3.375 747 12	0.21	686	3.375 753 30	0.53	77	-2.33	0.96	1.90
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022	2.568 758 04	0.13	2022	2.568 754 00	0.14	522	0.84	0.53	1.12
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55	2.219 023 55	0.07	55	2.219 020 11	0.19	25	-0.19	NA	NA
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372	1.892 712 69	0.06	372	1.892 707 68	0.38	232	0.92	0.54	1.06
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877	1.609 745 17	0.04	877	1.609 741 25	0.13	27	-0.18	0.36	0.73
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148	1.118 128 27	0.01	1148	1.118 127 72	0.12	15	-0.09	0.24	0.49
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303	0.844 151 59	0.04	303	0.844 152 46	0.08	33	-0.17	0.22	0.44
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625	0.215 909 23	0.03	6625	0.215 909 68	0.15	1282	-0.16	0.36	0.72

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM. (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST						NML					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			NRLM			BIPM-NRLM		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	NA	NA	NA
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	NA	NA	NA
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	NA	NA	NA
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	NA	NA	NA
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.28	0.14	0.27
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST						NML					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			NRLM			BNM/INM-NRLM		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U(95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	3.98	2.04	4.13
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	2.42	1.15	2.29
Cd FP	2.218 939 38	0.20	305 .	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	0.70	0.65	1.28
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	0.37	0.56	1.15
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.34	0.19	0.37
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	-0.27	0.41	0.81
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	IMGC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385

	NIST						NML					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			NRLM			IMGC-NRLM		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	-0.72	1.78	3.64
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	1.13	1.13	2.25
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	1.07	0.49	0.98
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	0.74	0.56	1.14
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.46	0.13	0.26
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.02	0.33	0.64
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir	KRISS			NML			NML			NRLM			KRISS-NRLM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 661 60	1.11	9	3.375 671 26	0.43	215	3.375 581 10	0.50	240	3.375 578 61	0.95	37	-2.24	2.02	4.28
Zn FP	2.568 700 00	0.63	15	2.568 701 29	0.21	267	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	1.48	1.21	2.46
Cd FP	NA	NA	NA	2.218 974 91	0.18	236	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 679 30	0.46	10	1.892 676 09	0.15	207	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	0.93	0.63	1.33
In FP	1.609 729 50	0.38	112	1.609 716 06	0.41	181	1.609 699 57	0.42	183	1.609 702 03	0.45	24	2.89	0.59	1.21
Ga MP	1.118 124 60	0.20	10	1.118 123 46	0.13	186	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.50	0.23	0.51
Hg TP	0.844 161 30	0.21	11	0.844 158 14	0.13	182	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.85	0.36	0.74
Ar TP	NA	NA	NA	0.215 941 86	0.49	120	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

inc	KRISS			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022
Cd FP	NA	NA	NA	2.218 980 47	0.07	55
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625

	NIST						NML					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			NRLM			KRISS-NRLM		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	-2.24	2.02	4.28
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	1.40	1.21	2.46
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	0.68	0.63	1.34
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	2.33	0.60	1.21
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.37	0.23	0.51
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.61	0.36	0.74
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir	MSL			NML			NML			NRLM			MSL-NRLM		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	3.375 581 10	0.50	240	3.375 578 61	0.95	37	NA	NA	NA
Zn FP	2.568 740 53	1.01	2	2.568 741 40	0.24	344	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	1.60	1.45	5.81
Cd FP	NA	NA	NA	2.219 011 08	0.20	305	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 703 74	0.47	6	1.892 703 57	0.16	245	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	0.11	0.65	1.46
In FP	1.609 739 76	0.39	14	1.609 737 15	0.42	183	1.609 699 57	0.42	183	1.609 702 03	0.45	24	0.04	0.61	1.28
Ga MP	1.118 128 26	0.18	1155135	1.118 127 46	0.13	194	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.41	0.21	0.42
Hg TP	0.844 152 71	0.19	21	0.844 152 43	0.13	191	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.13	0.36	0.71
Ar TP	NA	NA	NA	0.215 904 58	0.49	120	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

inc	**MSL**			**NIST**		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	NA	NA	NA	3.375 711 84	0.21	686
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022
Cd FP	NA	NA	NA	2.219 014 25	0.07	55
Sn FP	1.892 703 75	0.47	6	1.892 706 86	0.06	372
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625

	NIST						**NML**					
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*
Al FP	3.375 711 84	0.21	686	3.375 674 05	0.21	686	NA	NA	NA	3.375 671 26	0.43	215
Zn FP	2.568 743 16	0.13	2022	2.568 703 63	0.13	2022	2.568 741 40	0.24	344	2.568 701 29	0.21	267
Cd FP	2.219 014 25	0.07	55	2.218 980 47	0.07	55	2.219 011 08	0.20	305	2.218 974 91	0.18	236
Sn FP	1.892 706 86	0.06	372	1.892 681 25	0.06	372	1.892 703 57	0.16	245	1.892 676 09	0.15	207
In FP	1.609 741 29	0.04	877	1.609 724 44	0.04	877	1.609 737 15	0.42	183	1.609 716 06	0.41	181
Ga MP	1.118 127 59	0.01	1148	1.118 124 62	0.01	1148	1.118 127 46	0.13	194	1.118 123 46	0.13	186
Hg TP	0.844 151 65	0.04	303	0.844 159 29	0.04	303	0.844 152 43	0.13	191	0.844 158 14	0.13	182
Ar TP	0.215 913 88	0.03	6625	0.215 953 56	0.03	6625	0.215 904 58	0.49	120	0.215 941 86	0.49	120

	NML			**NRLM**			**MSL-NRLM**		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	NA	NA	NA
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	1.68	1.44	5.80
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	0.36	0.65	1.47
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	0.60	0.61	1.28
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.54	0.22	0.42
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.37	0.36	0.71
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir.	NIM			NML			NML			NRLM			NIM-NRLM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 663 92	1.39	13	3.375 671 26	0.43	215	3.375 581 10	0.50	240	3.375 578 61	0.95	37	-1.51	2.19	4.60
Zn FP	2.568 704 79	0.56	21	2.568 701 29	0.21	267	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	2.85	1.18	2.37
Cd FP	2.218 985 09	0.86	9	2.218 974 91	0.18	236	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 676 88	1.59	3	1.892 676 09	0.15	207	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	0.27	1.65	5.71
In FP	1.609 718 33	0.46	28	1.609 716 06	0.41	181	1.609 699 57	0.42	183	1.609 702 03	0.45	24	-0.05	0.65	1.34
Ga MP	1.118 122 28	0.28	36	1.118 123 46	0.13	186	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	-0.09	0.30	0.61
Hg TP	0.844 160 13	0.23	14	0.844 158 14	0.13	182	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.55	0.38	0.77
Ar TP	0.215 952 54	0.28	8	0.215 941 86	0.49	120	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

inc	**NIM**			**NIST**		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625

	NIST						**NML**					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			**NRLM**			**NIM-NRLM**		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	-1.51	2.19	4.60
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	2.77	1.18	2.37
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	0.02	1.65	5.72
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	-0.61	0.65	1.34
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	-0.22	0.30	0.61
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.31	0.38	0.77
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	**NIST**						**NML**					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			**NRLM**			**NIST-NRLM**		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	1.64	1.70	3.50
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	2.44	1.04	2.08
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	1.20	0.44	0.88
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	1.00	0.46	0.96
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.37	0.11	0.22
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.10	0.30	0.59
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

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dir & inc	**NML**			**NRLM**			**NML-NRLM**		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	0.77	1.71	3.50
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	1.85	1.05	2.09
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	0.06	0.45	0.90
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	-0.65	0.62	1.26
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.21	0.17	0.33
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.06	0.32	0.63
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST						NML					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			NRLM			NPL-NRLM		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	NA	NA	NA
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	2.29	1.13	2.25
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	0.93	0.57	1.13
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	0.32	0.57	1.17
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.21	0.24	0.48
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.21	0.35	0.69
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	NRC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625

	NIST						NML					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			NRLM			NRC-NRLM		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	3.57	1.78	3.65
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	1.28	1.06	2.15
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	-0.15	0.58	1.16
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	-0.03	0.49	1.01
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.23	0.17	0.35
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.32	0.31	0.61
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). dir. means direct and inc. means inclusive.

dir & inc	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST						NML					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

	NML			NRLM			PTB-NRLM		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	2.69	1.90	3.87
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	1.25	1.22	2.43
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	1.41	0.62	1.23
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	0.69	0.73	1.47
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.58	0.17	0.33
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.05	0.33	0.65
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST						NML					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			NRLM			SMU-NRLM		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	2.78	1.75	3.61
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	1.96	1.11	2.22
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	1.07	0.61	1.23
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	NA	NA	NA
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.41	0.15	0.29
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	**VNIIM**			**NIST**		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148
Hg TP	NA	NA	NA	0.844 157 56	0.04	303
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625

	NIST						**NML**					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			**NRLM**			**VNIIM-NRLM**		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	1.35	1.79	3.76
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	2.46	1.17	2.51
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	1.41	0.52	1.13
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	1.12	0.55	1.20
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.38	0.14	0.29
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Differences in realization of ITS-90 between Laboratory X and NRLM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625

	NIST						NML					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NML			NRLM			VSL-NRLM		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 581 10	0.50	240	3.375 578 61	0.95	37	1.23	1.87	3.81
Zn FP	2.568 653 91	0.24	344	2.568 647 44	0.88	4732	2.12	1.15	2.28
Cd FP	2.218 939 38	0.20	305	NA	NA	NA	NA	NA	NA
Sn FP	1.892 650 93	0.16	245	1.892 650 69	0.38	1303	0.77	0.57	1.15
In FP	1.609 699 57	0.42	183	1.609 702 03	0.45	24	-0.22	0.57	1.17
Ga MP	1.118 120 89	0.13	194	1.118 120 06	0.11	Inf	0.15	0.24	0.47
Hg TP	0.844 161 75	0.13	186	0.844 161 52	0.30	Inf	0.15	0.36	0.71
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB. dir. means direct and inc. means inclusive.

dir.	BIPM						PTB						BIPM-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	3.375 692 83	0.84	48985	3.375 761 10	0.88	3670	NA	NA	NA
Zn FP	NA	NA	NA	NA	NA	NA	2.568 714 64	0.64	1261745	2.568 764 20	0.66	54953	NA	NA	NA
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	NA	NA	NA	NA	NA	NA	1.892 686 64	0.44	263950	1.892 718 80	0.46	12660	NA	NA	NA
In FP	NA	NA	NA	NA	NA	NA	1.609 723 74	0.57	79186	1.609 747 50	0.59	3829	NA	NA	NA
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 16	0.12	176720	1.118 129 70	0.13	9094	-0.24	0.15	0.29
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 80	0.14	79186	0.844 149 90	0.15	3829	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	0.215 945 82	0.28	14496	0.215 907 60	0.31	881	NA	NA	NA

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

inc.	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									BIPM-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	NA	NA	NA
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	NA	NA	NA
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	NA	NA	NA
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	NA	NA	NA
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.30	0.14	0.29
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	NA	NA	NA
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	NA	NA	NA

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir.	BNM/INM						PTB						BNM/INM-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	0.29	1.40	2.76
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	0.51	0.81	1.59
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	-0.60	0.64	1.26
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	-0.10	0.65	1.28
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	-0.08	0.19	0.38
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	-0.45	0.32	0.63
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	-0.06	0.40	0.79

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

inc.	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									BNM/INM-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	1.29	1.41	2.78
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	1.17	0.81	1.61
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-0.71	0.65	1.27
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	-0.32	0.65	1.28
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.23	0.19	0.38
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	-0.32	0.32	0.63
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	-0.12	0.40	0.79

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir & inc	IMGC			NIST			NIST								
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									IMGC-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	-3.40	1.00	1.98
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	-0.12	0.78	1.55
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-0.33	0.49	0.97
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	0.05	0.65	1.28
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.12	0.14	0.27
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	-0.03	0.20	0.39
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	0.96	0.36	0.75

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir & inc	KRISS			NIST			NIST								
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	2.218 980 47	0.07	55	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									KRISS-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	-4.92	1.41	3.03
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	0.15	0.91	1.86
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-0.73	0.64	1.34
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	1.64	0.68	1.34
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.21	0.24	0.52
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	0.56	0.26	0.54
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	NA	NA	NA

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir & inc	MSL			NIST			NIST								
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	NA	NA	NA	3.375 711 84	0.21	686	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	2.219 014 25	0.07	55	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									MSL-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	NA	NA	NA
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	0.43	1.20	5.57
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-1.04	0.66	1.46
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	-0.09	0.69	1.40
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.03	0.22	0.43
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	0.32	0.24	0.50
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	NA	NA	NA

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir & inc	NIM			NIST						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									NIM-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	-4.20	1.64	3.46
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	1.52	0.86	1.74
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-1.38	1.65	5.72
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	-1.30	0.73	1.46
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.80	0.31	0.62
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	0.26	0.28	0.58
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	-0.01	0.40	0.86

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir & inc	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									NIST-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	-1.04	0.87	1.71
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	1.19	0.66	1.29
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-0.20	0.44	0.86
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	0.31	0.57	1.12
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.20	0.12	0.24
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	0.05	0.14	0.28
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	0.23	0.28	0.55

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir & inc	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									NML-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	-1.91	0.97	1.90
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	0.60	0.68	1.35
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-1.34	0.47	0.93
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	-1.34	0.70	1.38
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.37	0.18	0.35
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	0.01	0.19	0.38
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	-2.19	0.56	1.11

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir.	NPL						PTB						NPL-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	3.375 692 83	0.84	48985	3.375 761 10	0.88	3670	NA	NA	NA
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 714 64	0.64	1261745	2.568 764 20	0.66	54953	0.47	0.78	1.53
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 686 64	0.44	263950	1.892 718 80	0.46	12660	-0.60	0.57	1.11
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 723 74	0.57	79186	1.609 747 50	0.59	3829	-0.20	0.66	1.30
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 16	0.12	176720	1.118 129 70	0.13	9094	-0.31	0.25	0.48
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 80	0.14	79186	0.844 149 90	0.15	3829	0.24	0.24	0.46
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 945 82	0.28	14496	0.215 907 60	0.31	881	-0.80	0.45	0.87

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

inc.	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									NPL-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	NA	NA	NA
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	1.04	0.78	1.54
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-0.47	0.57	1.11
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	-0.37	0.66	1.30
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.37	0.24	0.48
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	0.16	0.24	0.46
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	-0.78	0.44	0.87

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir & inc	NRC			NIST			NIST								
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									NRC-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	0.88	1.01	2.00
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	0.03	0.68	1.40
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-1.55	0.59	1.15
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	-0.72	0.59	1.16
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.34	0.18	0.36
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	0.27	0.17	0.33
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	0.33	0.32	0.62

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	NRLM			NML			NML					
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240	3.375 671 26	0.43	215	NA	NA	NA
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344	2.568 701 29	0.21	267	2.568 741 40	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305	2.218 974 91	0.18	236	2.219 011 08	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245	1.892 676 09	0.15	207	1.892 703 57	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183	1.609 716 06	0.41	181	1.609 737 15	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194	1.118 123 46	0.13	186	1.118 127 46	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186	0.844 158 14	0.13	182	0.844 152 43	0.13	191
Ar TP	NA	NA	NA	NA	NA	NA	0.215 941 86	0.49	120	0.215 904 58	0.49	120

	NIST						NIST								
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 674 05	0.21	686	3.375 711 84	0.21	686	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 980 47	0.07	55	2.219 014 25	0.07	55	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 681 25	0.06	372	1.892 706 86	0.06	372	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 724 44	0.04	877	1.609 741 29	0.04	877	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 159 29	0.04	303	0.844 151 65	0.04	303	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									NRLM-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	-2.69	1.90	3.87
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	-1.25	1.22	2.43
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-1.41	0.62	1.23
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	-0.69	0.73	1.47
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.58	0.17	0.33
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	-0.05	0.33	0.65
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	NA	NA	NA

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir.	**SMU**						**PTB**						**SMU-PTB**		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 692 83	0.84	48985	3.375 761 10	0.88	3670	-0.51	0.95	1.89
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 714 64	0.64	1261745	2.568 764 20	0.66	54953	0.13	0.75	1.49
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 686 64	0.44	263950	1.892 718 80	0.46	12660	-0.46	0.61	1.21
In FP	NA	NA	NA	NA	NA	NA	1.609 723 74	0.57	79186	1.609 747 50	0.59	3829	NA	NA	NA
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 16	0.12	176720	1.118 129 70	0.13	9094	-0.10	0.16	0.31
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 80	0.14	79186	0.844 149 90	0.15	3829	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	0.215 945 82	0.28	14496	0.215 907 60	0.31	881	NA	NA	NA

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

inc.	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									SMU-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	0.10	0.96	1.91
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	0.71	0.76	1.50
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-0.34	0.61	1.21
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	NA	NA	NA
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.16	0.16	0.31
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	NA	NA	NA
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	NA	NA	NA

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir.	VNIIM			PTB			VNIIM-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	dir. ΔT, mK	u_c (k=1)	U(95%)
Al FP	3.375 678 20	0.54	5	3.375 692 83	0.84	48985	-4.56	1.00	2.17
Zn FP	2.568 710 20	0.54	5	2.568 714 64	0.64	1261745	-1.27	0.84	1.89
Cd FP	2.218 988 54	0.53	4	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 50	0.28	5	1.892 686 64	0.44	263950	-0.04	0.52	1.10
In FP	1.609 728 36	0.29	6	1.609 723 74	0.57	79186	1.21	0.64	1.32
Ga MP	1.118 125 03	0.08	8	1.118 124 16	0.12	176720	0.22	0.14	0.30
Hg TP	NA	NA	NA	0.844 157 80	0.14	79186	NA	NA	NA
Ar TP	NA	NA	NA	0.215 945 82	0.28	14496	NA	NA	NA

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

inc.	VNIIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148
Hg TP	NA	NA	NA	0.844 157 56	0.04	303
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									VNIIM-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	-1.34	1.01	2.20
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	1.21	0.84	1.91
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	0.00	0.52	1.11
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	0.43	0.64	1.32
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.20	0.14	0.30
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	NA	NA	NA
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	NA	NA	NA

Table 17. Differences in realization of ITS-90 between Laboratory X and PTB (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST			NIST								
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	DF	$W(T_{90})$ s/n 1094	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	PTB									VSL-PTB		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670	-1.45	1.16	2.29
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953	0.87	0.81	1.60
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660	-0.63	0.58	1.14
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829	-0.91	0.66	1.30
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094	-0.43	0.24	0.48
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829	0.10	0.25	0.50
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881	0.17	0.43	0.85

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU. dir. means direct and inc. means inclusive.

dir & inc	BIPM						SMU						BIPM-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	3.375 691 17	0.47	12	3.375 759 47	0.47	12	NA	NA	NA
Zn FP	NA	NA	NA	NA	NA	NA	2.568 717 97	0.41	35	2.568 761 80	0.41	35	NA	NA	NA
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	NA	NA	NA	NA	NA	NA	1.892 687 27	0.45	52	1.892 714 73	0.45	52	NA	NA	NA
In FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.13	0.12	0.24
Hg TP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

dir.	BNM/INM			SMU			BNM/INM-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 693 08	1.12	711852	3.375 691 17	0.47	12	0.60	1.22	2.43
Zn FP	2.568 719 35	0.52	75	2.568 717 97	0.41	35	0.39	0.66	1.33
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 51	0.48	468	1.892 687 27	0.45	52	-0.47	0.66	1.32
In FP	1.609 724 31	0.32	2205	NA	NA	NA	NA	NA	NA
Ga MP	1.118 123 65	0.15	8611	1.118 124 37	0.10	229	-0.18	0.18	0.35
Hg TP	0.844 156 18	0.29	5581	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 01	0.31	156	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

inc.	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST						SMU						BNM/INM-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	1.19	1.22	2.41
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	0.46	0.63	1.26
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	-0.37	0.64	1.27
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.07	0.18	0.35
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

dir & inc	**IMGC**			**NIST**		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385

	NIST						**SMU**						**IMGC-SMU**		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	-3.50	0.70	1.41
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	-0.83	0.59	1.19
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	0.00	0.49	0.97
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	0.05	0.11	0.23
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

dir & inc	KRISS			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022
Cd FP	NA	NA	NA	2.218 980 47	0.07	55
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625

	NIST						SMU						KRISS-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	-5.02	1.21	2.69
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	-0.56	0.75	1.57
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	-0.39	0.64	1.34
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.04	0.23	0.50
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

dir & inc	MSL			NIST		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	NA	NA	NA	3.375 711 84	0.21	686
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022
Cd FP	NA	NA	NA	2.219 014 25	0.07	55
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625

	NIST						SMU						MSL-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	-0.28	1.09	5.48
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	-0.71	0.65	1.46
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	0.13	0.21	0.41
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

dir & inc	NIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625

	NIST						SMU						NIM-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	-4.30	1.47	3.17
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	0.81	0.69	1.42
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	-1.05	1.65	5.72
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.63	0.30	0.60
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

dir & inc	NIST						SMU						NIST-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	-1.14	0.48	0.99
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	0.47	0.41	0.82
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	0.13	0.44	0.86
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.04	0.10	0.19
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

dir & inc	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF	$W(T_{90})$ s/n 4386	u_c (k=1)	DF	$W(T_{90})$ s/n 1032	u_c (k=1)	DF
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST						SMU						NML-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	-2.01	0.64	1.30
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	-0.11	0.45	0.90
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	-1.01	0.47	0.93
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.20	0.16	0.32
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

dir & inc	NPL						SMU						NPL-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	NA	NA	NA	3.375 691 17	0.47	12	3.375 759 47	0.47	12	NA	NA	NA
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 717 97	0.41	35	2.568 761 80	0.41	35	0.33	0.58	1.16
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 687 27	0.45	52	1.892 714 73	0.45	52	-0.14	0.56	1.10
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.21	0.23	0.46
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

dir & inc	NRC			NIST		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625

	NIST						SMU						NRC-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	0.78	0.71	1.44
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	-0.68	0.45	0.98
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	-1.22	0.58	1.15
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.18	0.16	0.33
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	NRLM			NML		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST						SMU						NRLM-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	-2.78	1.75	3.61
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	-1.96	1.11	2.22
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	-1.07	0.61	1.23
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.41	0.15	0.29
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

dir.	PTB						SMU						PTB-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 761 10	0.88	3670	3.375 691 17	0.47	12	3.375 759 47	0.47	12	0.51	0.95	1.89
Zn FP	2.568 714 64	0.64	1261745	2.568 764 20	0.66	54953	2.568 717 97	0.41	35	2.568 761 80	0.41	35	-0.13	0.75	1.49
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 718 80	0.46	12660	1.892 687 27	0.45	52	1.892 714 73	0.45	52	0.46	0.61	1.21
In FP	1.609 723 74	0.57	79186	1.609 747 50	0.59	3829	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 16	0.12	176720	1.118 129 70	0.13	9094	1.118 124 37	0.10	229	1.118 128 67	0.10	229	0.10	0.16	0.31
Hg TP	0.844 157 80	0.14	79186	0.844 149 90	0.15	3829	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 945 82	0.28	14496	0.215 907 60	0.31	881	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

inc. Fixed-Point	PTB								
	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

Fixed-Point	NIST								
	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030A	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

Fixed-Point	NIST						SMU						PTB-SMU		
	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	$W(T_{90})$ s/n 4385	u_c (k=1)	DF	$W(T_{90})$ s/n 1030B	u_c (k=1)	DF	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	-0.10	0.96	1.91
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	-0.71	0.76	1.50
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	0.34	0.61	1.21
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	0.16	0.16	0.31
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

dir.	VNIIM			SMU			VNIIM-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 678 20	0.54	5	3.375 691 17	0.47	12	-4.04	0.72	1.74
Zn FP	2.568 710 20	0.54	5	2.568 717 97	0.41	35	-2.22	0.68	1.64
Cd FP	2.218 988 54	0.53	4	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 50	0.28	5	1.892 687 27	0.45	52	-0.21	0.53	1.15
In FP	1.609 728 36	0.29	6	NA	NA	NA	NA	NA	NA
Ga MP	1.118 125 03	0.08	8	1.118 124 37	0.10	229	0.17	0.13	0.27
Hg TP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

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inc.	VNIIM			NIST		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148
Hg TP	NA	NA	NA	0.844 157 56	0.04	303
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625

	NIST						SMU						VNIIM-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	-1.44	0.71	1.69
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	0.50	0.67	1.62
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	0.34	0.52	1.11
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.03	0.12	0.26
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18. Differences in realization of ITS-90 between Laboratory X and SMU (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625

	NIST						SMU						VSL-SMU		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 679 15	0.21	686	3.375 764 15	0.25	353	3.375 691 17	0.47	12	3.375 759 47	0.47	12	-1.55	0.91	1.82
Zn FP	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059	2.568 717 97	0.41	35	2.568 761 80	0.41	35	0.16	0.63	1.25
Cd FP	2.218 987 11	0.07	55	2.219 033 18	0.09	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 717 23	0.09	335	1.892 687 27	0.45	52	1.892 714 73	0.45	52	-0.30	0.57	1.14
In FP	1.609 727 92	0.04	877	1.609 747 03	0.04	375	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	646	1.118 124 37	0.10	229	1.118 128 67	0.10	229	-0.27	0.23	0.45
Hg TP	0.844 157 56	0.04	303	0.844 151 19	0.05	281	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM. dir. means direct and inc. means inclusive.

dir.	BIPM			VNIIM			BIPM-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	3.375 678 20	0.54	5	NA	NA	NA
Zn FP	NA	NA	NA	2.568 710 20	0.54	5	NA	NA	NA
Cd FP	NA	NA	NA	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	NA	NA	NA	1.892 686 50	0.28	5	NA	NA	NA
In FP	NA	NA	NA	1.609 728 36	0.29	6	NA	NA	NA
Ga MP	1.118 123 20	0.08	198	1.118 125 03	0.08	8	-0.46	0.11	0.25
Hg TP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

inc.	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			VNIIM			BIPM-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 678 20	0.54	5	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	NA	NA	NA
Cd FP	2.218 987 11	0.07	55	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 686 50	0.28	5	NA	NA	NA
In FP	1.609 727 92	0.04	877	1.609 728 36	0.29	6	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	-0.10	0.11	0.24
Hg TP	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM (continued). dir. means direct and inc. means inclusive.

dir.	BNM/INM			VNIIM			BNM/INM-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 693 08	1.12	711852	3.375 678 20	0.54	5	4.64	1.25	2.61
Zn FP	2.568 719 35	0.52	75	2.568 710 20	0.54	5	2.61	0.75	1.75
Cd FP	NA	NA	NA	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 685 51	0.48	468	1.892 686 50	0.28	5	-0.27	0.56	1.18
In FP	1.609 724 31	0.32	2205	1.609 728 36	0.29	6	-1.07	0.44	0.95
Ga MP	1.118 123 65	0.15	8611	1.118 125 03	0.08	8	-0.35	0.17	0.34
Hg TP	0.844 156 18	0.29	5581	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 01	0.31	156	NA	NA	NA	NA	NA	NA

inc.	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST			VNIIM			BNM/INM-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 679 15	0.21	686	3.375 678 20	0.54	5	2.63	1.26	2.63
Zn FP	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-0.04	0.73	1.72
Cd FP	2.218 987 11	0.07	55	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-0.71	0.55	1.17
In FP	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-0.75	0.44	0.96
Ga MP	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	-0.04	0.17	0.34
Hg TP	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM (continued). dir. means direct and inc. means inclusive.

dir & inc	IMGC			NIST			NIST			VNIIM			IMGC-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353	3.375 679 15	0.21	686	3.375 678 20	0.54	5	-2.06	0.77	1.78
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-1.33	0.70	1.67
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44	2.218 987 11	0.07	55	2.218 988 54	0.53	4	-1.87	0.63	1.60
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-0.33	0.36	0.84
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-0.38	0.43	0.95
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	0.08	0.10	0.23
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

dir & inc	KRISS			NIST			NIST			VNIIM			KRISS-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686	3.375 679 15	0.21	686	3.375 678 20	0.54	5	-3.58	1.25	2.90
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-1.06	0.84	1.96
Cd FP	NA	NA	NA	2.218 980 47	0.07	55	2.218 987 11	0.07	55	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-0.73	0.54	1.25
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877	1.609 727 92	0.04	877	1.609 728 36	0.29	6	1.22	0.48	1.03
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	-0.01	0.22	0.49
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

dir & inc	MSL			NIST			NIST			VNIIM			MSL-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	3.375 711 84	0.21	686	3.375 679 15	0.21	686	3.375 678 20	0.54	5	NA	NA	NA
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-0.78	1.15	5.61
Cd FP	NA	NA	NA	2.219 014 25	0.07	55	2.218 987 11	0.07	55	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-1.04	0.57	1.38
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-0.52	0.50	1.11
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	0.16	0.20	0.40
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM (continued). dir. means direct and inc. means inclusive.

dir & inc	NIM			NIST			NIST			VNIIM			NIM-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686	3.375 679 15	0.21	686	3.375 678 20	0.54	5	-2.86	1.51	3.35
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	0.31	0.79	1.84
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55	2.218 987 11	0.07	55	2.218 988 54	0.53	4	0.89	1.02	2.44
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-1.38	1.62	5.70
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-1.72	0.55	1.18
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	-0.60	0.29	0.60
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

dir & inc	NIST			VNIIM			NIST-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 678 20	0.54	5	0.29	0.58	1.47
Zn FP	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-0.02	0.55	1.43
Cd FP	2.218 987 11	0.07	55	2.218 988 54	0.53	4	-0.40	0.54	1.46
Sn FP	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-0.20	0.28	0.71
In FP	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-0.11	0.30	0.72
Ga MP	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	-0.01	0.08	0.19
Hg TP	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM (continued). dir. means direct and inc. means inclusive.

dir & inc	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			VNIIM			NML-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 678 20	0.54	5	-0.57	0.72	1.69
Zn FP	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-0.61	0.59	1.48
Cd FP	2.218 987 11	0.07	55	2.218 988 54	0.53	4	-1.61	0.58	1.51
Sn FP	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-1.34	0.33	0.79
In FP	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-1.76	0.51	1.09
Ga MP	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	-0.17	0.15	0.32
Hg TP	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

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dir.	NPL			VNIIM			NPL-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	NA	NA	NA	3.375 678 20	0.54	5	NA	NA	NA
Zn FP	2.568 719 60	0.44	7969	2.568 710 20	0.54	5	2.69	0.69	1.65
Cd FP	NA	NA	NA	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 683 05	0.36	1921	1.892 686 50	0.28	5	-0.93	0.46	1.00
In FP	1.609 722 05	0.34	1543	1.609 728 36	0.29	6	-1.66	0.45	0.98
Ga MP	1.118 123 10	0.22	50	1.118 125 03	0.08	8	-0.49	0.24	0.49
Hg TP	0.844 158 45	0.20	131	NA	NA	NA	NA	NA	NA
Ar TP	0.215 943 20	0.36	126	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM (continued). dir. means direct and inc. means inclusive.

inc.	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			VNIIM			NPL-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 678 20	0.54	5	NA	NA	NA
Zn FP	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-0.17	0.70	1.66
Cd FP	2.218 987 11	0.07	55	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-0.47	0.46	1.00
In FP	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-0.80	0.45	0.98
Ga MP	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	-0.18	0.23	0.46
Hg TP	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

dir & inc	NRC			NIST			NIST			VNIIM			NRC-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686	3.375 679 15	0.21	686	3.375 678 20	0.54	5	2.22	0.78	1.80
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-1.18	0.58	1.53
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55	2.218 987 11	0.07	55	2.218 988 54	0.53	4	-1.35	0.58	1.51
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-1.55	0.48	1.04
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-1.15	0.33	0.78
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	-0.15	0.15	0.32
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	NRLM			NML		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			VNIIM			NRLM-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 678 20	0.54	5	-1.35	1.79	3.76
Zn FP	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-2.46	1.17	2.51
Cd FP	2.218 987 11	0.07	55	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-1.41	0.52	1.13
In FP	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-1.12	0.55	1.20
Ga MP	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	-0.38	0.14	0.29
Hg TP	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM (continued). dir. means direct and inc. means inclusive.

dir.	PTB			VNIIM			PTB-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 692 83	0.84	48985	3.375 678 20	0.54	5	4.56	1.00	2.17
Zn FP	2.568 714 64	0.64	1261745	2.568 710 20	0.54	5	1.27	0.84	1.89
Cd FP	NA	NA	NA	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 686 50	0.28	5	0.04	0.52	1.10
In FP	1.609 723 74	0.57	79186	1.609 728 36	0.29	6	-1.21	0.64	1.32
Ga MP	1.118 124 16	0.12	176720	1.118 125 03	0.08	8	-0.22	0.14	0.30
Hg TP	0.844 157 80	0.14	79186	NA	NA	NA	NA	NA	NA
Ar TP	0.215 945 82	0.28	14496	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM (continued). dir. means direct and inc. means inclusive.

inc.	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST			VNIIM			PTB-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 679 15	0.21	686	3.375 678 20	0.54	5	1.34	1.01	2.20
Zn FP	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-1.21	0.84	1.91
Cd FP	2.218 987 11	0.07	55	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 686 50	0.28	5	0.00	0.52	1.11
In FP	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-0.43	0.64	1.32
Ga MP	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	0.20	0.14	0.30
Hg TP	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM (continued). dir. means direct and inc. means inclusive.

dir.	SMU			VNIIM			SMU-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 691 17	0.47	12	3.375 678 20	0.54	5	4.04	0.72	1.74
Zn FP	2.568 717 97	0.41	35	2.568 710 20	0.54	5	2.22	0.68	1.64
Cd FP	NA	NA	NA	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 687 27	0.45	52	1.892 686 50	0.28	5	0.21	0.53	1.15
In FP	NA	NA	NA	1.609 728 36	0.29	6	NA	NA	NA
Ga MP	1.118 124 37	0.10	229	1.118 125 03	0.08	8	-0.17	0.13	0.27
Hg TP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ar TP	NA	NA	NA	NA	NA	NA	NA	NA	NA

inc.	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			VNIIM			SMU-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	inc. ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 679 15	0.21	686	3.375 678 20	0.54	5	1.44	0.71	1.69
Zn FP	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-0.50	0.67	1.62
Cd FP	2.218 987 11	0.07	55	2.218 988 54	0.53	4	NA	NA	NA
Sn FP	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-0.34	0.52	1.11
In FP	1.609 727 92	0.04	877	1.609 728 36	0.29	6	NA	NA	NA
Ga MP	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	0.03	0.12	0.26
Hg TP	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

Table 19. Differences in realization of ITS-90 between Laboratory X and VNIIM (continued). dir. means direct and inc. means inclusive.

dir & inc	VSL			NIST			NIST			VNIIM			VSL-VNIIM		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 731 25	0.77	129	3.375 732 56	0.21	686	3.375 679 15	0.21	686	3.375 678 20	0.54	5	-0.11	0.97	2.12
Zn FP	2.568 746 43	0.48	206	2.568 747 52	0.13	2022	2.568 710 12	0.13	2022	2.568 710 20	0.54	5	-0.33	0.73	1.71
Cd FP	2.219 015 43	NA	NA	2.219 019 53	0.07	55	2.218 987 11	0.07	55	2.218 988 54	0.53	4	-1.54	NA	NA
Sn FP	1.892 710 70	0.37	239	1.892 712 29	0.06	372	1.892 685 74	0.06	372	1.892 686 50	0.28	5	-0.63	0.47	1.02
In FP	1.609 741 78	0.33	66	1.609 746 41	0.04	877	1.609 727 92	0.04	877	1.609 728 36	0.29	6	-1.33	0.44	0.97
Ga MP	1.118 128 87	0.21	980	1.118 129 76	0.01	1148	1.118 124 99	0.01	1148	1.118 125 03	0.08	8	-0.23	0.22	0.45
Hg TP	0.844 151 64	0.20	211	0.844 151 47	0.04	303	0.844 157 56	0.04	303	NA	NA	NA	NA	NA	NA
Ar TP	0.215 910 32	0.33	71	0.215 910 58	0.03	6625	0.215 947 09	0.03	6625	NA	NA	NA	NA	NA	NA

Table 20. Differences in realization of ITS-90 between Laboratory X and VSL. dir. means direct and inc. means inclusive.

dir & inc	BIPM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	NA	NA	NA	NA	NA	NA	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	NA	NA	NA	NA	NA	NA	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 20	0.08	198	1.118 128 80	0.08	198	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			VSL			BIPM-VSL		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 732 56	0.21	686	3.375 731 25	0.77	129	NA	NA	NA
Zn FP	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	NA	NA	NA
Cd FP	2.219 019 53	0.07	55	2.219 015 43	NA	NA	NA	NA	NA
Sn FP	1.892 712 29	0.06	372	1.892 710 70	0.37	239	NA	NA	NA
In FP	1.609 746 41	0.04	877	1.609 741 78	0.33	66	NA	NA	NA
Ga MP	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.13	0.22	0.44
Hg TP	0.844 151 47	0.04	303	0.844 151 64	0.20	211	NA	NA	NA
Ar TP	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	NA	NA	NA

Table 20. Differences in realization of ITS-90 between Laboratory X and VSL (continued). dir. means direct and inc. means inclusive.

dir & inc	BNM/INM						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*
Al FP	3.375 693 08	1.12	711852	3.375 762 55	1.12	317218	3.375 679 15	0.21	686	3.375 761 50	0.23	506
Zn FP	2.568 719 35	0.52	75	2.568 762 04	0.52	75	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 031 68	0.08	49
Sn FP	1.892 685 51	0.48	468	1.892 712 54	0.48	468	1.892 685 74	0.06	372	1.892 716 03	0.07	353
In FP	1.609 724 31	0.32	2205	1.609 744 72	0.32	2205	1.609 727 92	0.04	877	1.609 745 91	0.04	599
Ga MP	1.118 123 65	0.15	8611	1.118 128 85	0.15	15125	1.118 124 99	0.01	1148	1.118 127 72	0.02	879
Hg TP	0.844 156 18	0.29	5581	0.844 149 44	0.29	5581	0.844 157 56	0.04	303	0.844 151 02	0.04	292
Ar TP	0.215 947 01	0.31	156	0.215 905 47	0.31	156	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240

	NIST			VSL			BNM/INM-VSL		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 732 56	0.21	686	3.375 731 25	0.77	129	2.74	1.38	2.72
Zn FP	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	0.30	0.70	1.38
Cd FP	2.219 019 53	0.07	55	2.219 015 43	NA	NA	NA	NA	NA
Sn FP	1.892 712 29	0.06	372	1.892 710 70	0.37	239	-0.07	0.61	1.19
In FP	1.609 746 41	0.04	877	1.609 741 78	0.33	66	0.58	0.46	0.92
Ga MP	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.20	0.26	0.50
Hg TP	0.844 151 47	0.04	303	0.844 151 64	0.20	211	-0.41	0.35	0.70
Ar TP	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	-0.29	0.44	0.87

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dir & inc	IMGC			NIST			NIST			VSL			IMGC-VSL		
Fixed-Point	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 739 99	0.49	87	3.375 747 56	0.25	353	3.375 732 56	0.21	686	3.375 731 25	0.77	129	-1.95	0.95	1.88
Zn FP	2.568 754 54	0.42	40	2.568 759 10	0.16	1059	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	-0.99	0.66	1.31
Cd FP	2.219 019 11	0.32	181	2.219 024 40	0.09	44	2.219 019 53	0.07	55	2.219 015 43	NA	NA	-0.33	NA	NA
Sn FP	1.892 713 07	0.21	141	1.892 713 55	0.09	335	1.892 712 29	0.06	372	1.892 710 70	0.37	239	0.30	0.44	0.86
In FP	1.609 744 75	0.31	118	1.609 745 74	0.04	375	1.609 746 41	0.04	877	1.609 741 78	0.33	66	0.96	0.46	0.91
Ga MP	1.118 128 69	0.06	18	1.118 128 35	0.02	646	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.31	0.22	0.43
Hg TP	0.844 151 19	0.13	977	0.844 151 53	0.05	281	0.844 151 47	0.04	303	0.844 151 64	0.20	211	-0.13	0.25	0.49
Ar TP	0.215 912 46	0.23	9	0.215 909 29	0.04	2385	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	0.79	0.40	0.84

Table 20. Differences in realization of ITS-90 between Laboratory X and VSL (continued). dir. means direct and inc. means inclusive.

dir & inc	KRISS			NIST			NIST			VSL			KRISS-VSL		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 661 60	1.11	9	3.375 674 05	0.21	686	3.375 732 56	0.21	686	3.375 731 25	0.77	129	-3.47	1.37	2.96
Zn FP	2.568 700 00	0.63	15	2.568 703 63	0.13	2022	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	-0.73	0.80	1.66
Cd FP	NA	NA	NA	2.218 980 47	0.07	55	2.219 019 53	0.07	55	2.219 015 43	NA	NA	NA	NA	NA
Sn FP	1.892 679 30	0.46	10	1.892 681 25	0.06	372	1.892 712 29	0.06	372	1.892 710 70	0.37	239	-0.10	0.60	1.26
In FP	1.609 729 50	0.38	112	1.609 724 44	0.04	877	1.609 746 41	0.04	877	1.609 741 78	0.33	66	2.55	0.50	1.00
Ga MP	1.118 124 60	0.20	10	1.118 124 62	0.01	1148	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.22	0.29	0.62
Hg TP	0.844 161 30	0.21	11	0.844 159 29	0.04	303	0.844 151 47	0.04	303	0.844 151 64	0.20	211	0.46	0.30	0.62
Ar TP	NA	NA	NA	0.215 953 56	0.03	6625	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	NA	NA	NA

dir & inc	MSL			NIST			NIST			VSL			MSL-VSL		
Fixed-Point	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	NA	NA	NA	3.375 711 84	0.21	686	3.375 732 56	0.21	686	3.375 731 25	0.77	129	NA	NA	NA
Zn FP	2.568 740 53	1.01	2	2.568 743 16	0.13	2022	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	-0.44	1.12	5.51
Cd FP	NA	NA	NA	2.219 014 25	0.07	55	2.219 019 53	0.07	55	2.219 015 43	NA	NA	NA	NA	NA
Sn FP	1.892 703 74	0.47	6	1.892 706 86	0.06	372	1.892 712 29	0.06	372	1.892 710 70	0.37	239	-0.41	0.62	1.39
In FP	1.609 739 76	0.39	14	1.609 741 29	0.04	877	1.609 746 41	0.04	877	1.609 741 78	0.33	66	0.81	0.52	1.08
Ga MP	1.118 128 26	0.18	1155135	1.118 127 59	0.01	1148	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.40	0.28	0.55
Hg TP	0.844 152 71	0.19	21	0.844 151 65	0.04	303	0.844 151 47	0.04	303	0.844 151 64	0.20	211	0.22	0.29	0.58
Ar TP	NA	NA	NA	0.215 913 88	0.03	6625	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	NA	NA	NA

dir & inc	NIM			NIST			NIST			VSL			NIM-VSL		
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 663 92	1.39	13	3.375 674 05	0.21	686	3.375 732 56	0.21	686	3.375 731 25	0.77	129	-2.75	1.61	3.41
Zn FP	2.568 704 79	0.56	21	2.568 703 63	0.13	2022	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	0.64	0.75	1.52
Cd FP	2.218 985 09	0.86	9	2.218 980 47	0.07	55	2.219 019 53	0.07	55	2.219 015 43	NA	NA	2.42	NA	NA
Sn FP	1.892 676 88	1.59	3	1.892 681 25	0.06	372	1.892 712 29	0.06	372	1.892 710 70	0.37	239	-0.75	1.63	5.70
In FP	1.609 718 33	0.46	28	1.609 724 44	0.04	877	1.609 746 41	0.04	877	1.609 741 78	0.33	66	-0.39	0.56	1.15
Ga MP	1.118 122 28	0.28	36	1.118 124 62	0.01	1148	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	-0.37	0.35	0.70
Hg TP	0.844 160 13	0.23	14	0.844 159 29	0.04	303	0.844 151 47	0.04	303	0.844 151 64	0.20	211	0.17	0.31	0.65
Ar TP	0.215 952 54	0.28	8	0.215 953 56	0.03	6625	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	-0.18	0.44	0.93

Table 20. Differences in realization of ITS-90 between Laboratory X and VSL. dir. means direct and inc. means inclusive.

dir & inc	NIST			VSL			NIST-VSL		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 732 56	0.21	686	3.375 731 25	0.77	129	0.41	0.80	1.59
Zn FP	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	0.31	0.50	0.98
Cd FP	2.219 019 53	0.07	55	2.219 015 43	NA	NA	1.14	NA	NA
Sn FP	1.892 712 29	0.06	372	1.892 710 70	0.37	239	0.43	0.38	0.74
In FP	1.609 746 41	0.04	877	1.609 741 78	0.33	66	1.22	0.33	0.67
Ga MP	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.23	0.21	0.41
Hg TP	0.844 151 47	0.04	303	0.844 151 64	0.20	211	-0.04	0.21	0.41
Ar TP	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	0.06	0.33	0.66

dir & inc	NML						NIST					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			VSL			NML-VSL		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 732 56	0.21	686	3.375 731 25	0.77	129	-0.46	0.91	1.80
Zn FP	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	-0.28	0.53	1.05
Cd FP	2.219 019 53	0.07	55	2.219 015 43	NA	NA	-0.07	NA	NA
Sn FP	1.892 712 29	0.06	372	1.892 710 70	0.37	239	-0.71	0.41	0.82
In FP	1.609 746 41	0.04	877	1.609 741 78	0.33	66	-0.43	0.53	1.06
Ga MP	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.06	0.25	0.48
Hg TP	0.844 151 47	0.04	303	0.844 151 64	0.20	211	-0.09	0.24	0.48
Ar TP	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	-2.36	0.59	1.17

Table 20. Differences in realization of ITS-90 between Laboratory X and VSL (continued). dir. means direct and inc. means inclusive.

dir & inc	NPL						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	NA	NA	NA	NA	NA	NA	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 719 60	0.44	7969	2.568 762 50	0.44	7969	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 683 05	0.36	1921	1.892 717 93	0.36	4139	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	1.609 722 05	0.34	1543	1.609 747 70	0.34	1543	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 123 10	0.22	50	1.118 128 30	0.22	50	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	0.844 158 45	0.20	131	0.844 151 15	0.20	131	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	0.215 943 20	0.36	126	0.215 903 23	0.35	251	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			VSL			NPL-VSL		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 732 56	0.21	686	3.375 731 25	0.77	129	NA	NA	NA
Zn FP	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	0.17	0.66	1.31
Cd FP	2.219 019 53	0.07	55	2.219 015 43	NA	NA	NA	NA	NA
Sn FP	1.892 712 29	0.06	372	1.892 710 70	0.37	239	0.16	0.52	1.03
In FP	1.609 746 41	0.04	877	1.609 741 78	0.33	66	0.53	0.47	0.94
Ga MP	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.06	0.30	0.59
Hg TP	0.844 151 47	0.04	303	0.844 151 64	0.20	211	0.06	0.28	0.55
Ar TP	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	-0.95	0.48	0.94

Table 20. Differences in realization of ITS-90 between Laboratory X and VSL (continued). dir. means direct and inc. means inclusive.

dir & inc	NRC			NIST			NIST			VSL			NRC-VSL		
Fixed-Point	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1098A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 753 30	0.53	77	3.375 747 12	0.21	686	3.375 732 56	0.21	686	3.375 731 25	0.77	129	2.33	0.96	1.90
Zn FP	2.568 754 00	0.14	522	2.568 758 04	0.13	2022	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	-0.84	0.53	1.12
Cd FP	2.219 020 11	0.19	25	2.219 023 55	0.07	55	2.219 019 53	0.07	55	2.219 015 43	NA	NA	0.19	NA	NA
Sn FP	1.892 707 68	0.38	232	1.892 712 69	0.06	372	1.892 712 29	0.06	372	1.892 710 70	0.37	239	-0.92	0.54	1.06
In FP	1.609 741 25	0.13	27	1.609 745 17	0.04	877	1.609 746 41	0.04	877	1.609 741 78	0.33	66	0.18	0.36	0.73
Ga MP	1.118 127 72	0.12	15	1.118 128 27	0.01	1148	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.09	0.24	0.49
Hg TP	0.844 152 46	0.08	33	0.844 151 59	0.04	303	0.844 151 47	0.04	303	0.844 151 64	0.20	211	0.17	0.22	0.44
Ar TP	0.215 909 68	0.15	1282	0.215 909 23	0.03	6625	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	0.16	0.36	0.72

Table 20. Differences in realization of ITS-90 between Laboratory X and VSL (continued). (*DF*= Inf indicates Type B evaluation of uncertainties.) dir. means direct and inc. means inclusive.

dir & inc	**NRLM**			**NML**		
Fixed-Point	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*	$W(T_{90})$ s/n 040	u_c (k=1)	*DF*
Al FP	3.375 578 61	0.95	37	3.375 581 10	0.50	240
Zn FP	2.568 647 44	0.88	4732	2.568 653 91	0.24	344
Cd FP	NA	NA	NA	2.218 939 38	0.20	305
Sn FP	1.892 650 69	0.38	1303	1.892 650 93	0.16	245
In FP	1.609 702 03	0.45	24	1.609 699 57	0.42	183
Ga MP	1.118 120 06	0.11	Inf	1.118 120 89	0.13	194
Hg TP	0.844 161 52	0.30	Inf	0.844 161 75	0.13	186
Ar TP	NA	NA	NA	NA	NA	NA

	NML						**NIST**					
Fixed-Point	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4386	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1032	u_c (k=1)	*DF*
Al FP	3.375 671 26	0.43	215	NA	NA	NA	3.375 674 05	0.21	686	3.375 711 84	0.21	686
Zn FP	2.568 701 29	0.21	267	2.568 741 40	0.24	344	2.568 703 63	0.13	2022	2.568 743 16	0.13	2022
Cd FP	2.218 974 91	0.18	236	2.219 011 08	0.20	305	2.218 980 47	0.07	55	2.219 014 25	0.07	55
Sn FP	1.892 676 09	0.15	207	1.892 703 57	0.16	245	1.892 681 25	0.06	372	1.892 706 86	0.06	372
In FP	1.609 716 06	0.41	181	1.609 737 15	0.42	183	1.609 724 44	0.04	877	1.609 741 29	0.04	877
Ga MP	1.118 123 46	0.13	186	1.118 127 46	0.13	194	1.118 124 62	0.01	1148	1.118 127 59	0.01	1148
Hg TP	0.844 158 14	0.13	182	0.844 152 43	0.13	191	0.844 159 29	0.04	303	0.844 151 65	0.04	303
Ar TP	0.215 941 86	0.49	120	0.215 904 58	0.49	120	0.215 953 56	0.03	6625	0.215 913 88	0.03	6625

	NIST			**VSL**			**NRLM-VSL**		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 732 56	0.21	686	3.375 731 25	0.77	129	-1.23	1.87	3.81
Zn FP	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	-2.12	1.15	2.28
Cd FP	2.219 019 53	0.07	55	2.219 015 43	NA	NA	NA	NA	NA
Sn FP	1.892 712 29	0.06	372	1.892 710 70	0.37	239	-0.77	0.57	1.15
In FP	1.609 746 41	0.04	877	1.609 741 78	0.33	66	0.22	0.57	1.17
Ga MP	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	-0.15	0.24	0.47
Hg TP	0.844 151 47	0.04	303	0.844 151 64	0.20	211	-0.15	0.36	0.71
Ar TP	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	NA	NA	NA

Table 20. Differences in realization of ITS-90 between Laboratory X and VSL (continued). dir. means direct and inc. means inclusive.

dir & inc	PTB								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 692 83	0.84	48985	3.375 760 93	0.85	28138	3.375 761 10	0.88	3670
Zn FP	2.568 714 64	0.64	1261745	2.568 763 17	0.65	460834	2.568 764 20	0.66	54953
Cd FP	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sn FP	1.892 686 64	0.44	263950	1.892 715 83	0.44	98056	1.892 718 80	0.46	12660
In FP	1.609 723 74	0.57	79186	1.609 746 07	0.57	29460	1.609 747 50	0.59	3829
Ga MP	1.118 124 16	0.12	176720	1.118 129 00	0.12	66498	1.118 129 70	0.13	9094
Hg TP	0.844 157 80	0.14	79186	0.844 151 43	0.14	29460	0.844 149 90	0.15	3829
Ar TP	0.215 945 82	0.28	14496	0.215 907 20	0.28	5631	0.215 907 60	0.31	881

	NIST								
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030A	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 679 15	0.21	686	3.375 761 50	0.23	506	3.375 764 15	0.25	353
Zn FP	2.568 710 12	0.13	2022	2.568 771 37	0.14	1502	2.568 772 97	0.16	1059
Cd FP	2.218 987 11	0.07	55	2.219 031 68	0.08	49	2.219 033 18	0.09	44
Sn FP	1.892 685 74	0.06	372	1.892 716 03	0.07	353	1.892 717 23	0.09	335
In FP	1.609 727 92	0.04	877	1.609 745 91	0.04	599	1.609 747 03	0.04	375
Ga MP	1.118 124 99	0.01	1148	1.118 127 72	0.02	879	1.118 127 72	0.02	646
Hg TP	0.844 157 56	0.04	303	0.844 151 02	0.04	292	0.844 151 19	0.05	281
Ar TP	0.215 947 09	0.03	6625	0.215 908 39	0.03	4240	0.215 908 09	0.04	2385

	NIST			VSL			PTB-VSL		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	*U* (95%)
Al FP	3.375 732 56	0.21	686	3.375 731 25	0.77	129	1.45	1.16	2.29
Zn FP	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	-0.87	0.81	1.60
Cd FP	2.219 019 53	0.07	55	2.219 015 43	NA	NA	NA	NA	NA
Sn FP	1.892 712 29	0.06	372	1.892 710 70	0.37	239	0.63	0.58	1.14
In FP	1.609 746 41	0.04	877	1.609 741 78	0.33	66	0.91	0.66	1.30
Ga MP	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.43	0.24	0.48
Hg TP	0.844 151 47	0.04	303	0.844 151 64	0.20	211	-0.10	0.25	0.50
Ar TP	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	-0.17	0.43	0.85

Table 20. Differences in realization of ITS-90 between Laboratory X and VSL (continued). dir. means direct and inc. means inclusive.

dir & inc	SMU						NIST					
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1030B	u_c (k=1)	*DF*
Al FP	3.375 691 17	0.47	12	3.375 759 47	0.47	12	3.375 679 15	0.21	686	3.375 764 15	0.25	353
Zn FP	2.568 717 97	0.41	35	2.568 761 80	0.41	35	2.568 710 12	0.13	2022	2.568 772 97	0.16	1059
Cd FP	NA	NA	NA	NA	NA	NA	2.218 987 11	0.07	55	2.219 033 18	0.09	44
Sn FP	1.892 687 27	0.45	52	1.892 714 73	0.45	52	1.892 685 74	0.06	372	1.892 717 23	0.09	335
In FP	NA	NA	NA	NA	NA	NA	1.609 727 92	0.04	877	1.609 747 03	0.04	375
Ga MP	1.118 124 37	0.10	229	1.118 128 67	0.10	229	1.118 124 99	0.01	1148	1.118 127 72	0.02	646
Hg TP	NA	NA	NA	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 19	0.05	281
Ar TP	NA	NA	NA	NA	NA	NA	0.215 947 09	0.03	6625	0.215 908 09	0.04	2385

	NIST			VSL			SMU-VSL		
Fixed-Point	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 732 56	0.21	686	3.375 731 25	0.77	129	1.55	0.91	1.82
Zn FP	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	-0.16	0.63	1.25
Cd FP	2.219 019 53	0.07	55	2.219 015 43	NA	NA	NA	NA	NA
Sn FP	1.892 712 29	0.06	372	1.892 710 70	0.37	239	0.30	0.57	1.14
In FP	1.609 746 41	0.04	877	1.609 741 78	0.33	66	NA	NA	NA
Ga MP	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.27	0.23	0.45
Hg TP	0.844 151 47	0.04	303	0.844 151 64	0.20	211	NA	NA	NA
Ar TP	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	NA	NA	NA

dir & inc	VNIIM			NIST			NIST			VSL			VNIIM-VSL		
Fixed-Point	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 4385	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	$W(T_{90})$ s/n 1094	u_c (k=1)	*DF*	dir & inc ΔT, mK	u_c (k=1)	U (95%)
Al FP	3.375 678 20	0.54	5	3.375 679 15	0.21	686	3.375 732 56	0.21	686	3.375 731 25	0.77	129	0.11	0.97	2.12
Zn FP	2.568 710 20	0.54	5	2.568 710 12	0.13	2022	2.568 747 52	0.13	2022	2.568 746 43	0.48	206	0.33	0.73	1.71
Cd FP	2.218 988 54	0.53	4	2.218 987 11	0.07	55	2.219 019 53	0.07	55	2.219 015 43	NA	NA	1.54	NA	NA
Sn FP	1.892 686 50	0.28	5	1.892 685 74	0.06	372	1.892 712 29	0.06	372	1.892 710 70	0.37	239	0.63	0.47	1.02
In FP	1.609 728 36	0.29	6	1.609 727 92	0.04	877	1.609 746 41	0.04	877	1.609 741 78	0.33	66	1.33	0.44	0.97
Ga MP	1.118 125 03	0.08	8	1.118 124 99	0.01	1148	1.118 129 76	0.01	1148	1.118 128 87	0.21	980	0.23	0.22	0.45
Hg TP	NA	NA	NA	0.844 157 56	0.04	303	0.844 151 47	0.04	303	0.844 151 64	0.20	211	NA	NA	NA
Ar TP	NA	NA	NA	0.215 947 09	0.03	6625	0.215 910 58	0.03	6625	0.215 910 32	0.33	71	NA	NA	NA

Table 21. Summary of differences of realizations and of their expanded uncertainties U (95 %) between laboratories for Al, where ΔT/mK = column – row. U is expressed in mK. For information on why dir. and inc. values are different, see Section 5.2.

	BIPM		BNM		IMGC		KRISS		MSL		NIM		NIST		NML		NPL		NRC		NRLM		PTB		SMU		VNIIM		VSL		
	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	
BIPM																															ΔT
																															U
BNM					-4.69	-4.69	-6.21	-6.21			-5.49	-5.49	-2.33	-2.33	-3.20	-3.20			-0.41	-0.41	-3.98	-3.98	-0.29	-1.29	-0.60	-1.19	-4.64	-2.63	-2.74	-2.74	ΔT
					2.46	2.46	3.36	3.36			3.76	3.76	2.25	2.25	2.40	2.40			2.48	2.48	4.13	4.13	2.76	2.78	2.43	2.41	2.61	2.63	2.72	2.72	U
IMGC			4.69	4.69			-1.52	-1.52			-0.80	-0.80	2.36	2.36	1.49	1.49			4.29	4.29	0.72	0.72	3.40	3.40	3.50	3.50	2.06	2.06	1.95	1.95	ΔT
			2.46	2.46			2.73	2.73			3.21	3.21	1.10	1.10	1.38	1.38			1.49	1.49	3.64	3.64	1.98	1.98	1.41	1.41	1.78	1.78	1.88	1.88	U
KRISS			6.21	6.21	1.52	1.52					0.72	0.72	3.88	3.88	3.01	3.01			5.81	5.81	2.24	2.24	4.92	4.92	5.02	5.02	3.58	3.58	3.47	3.47	ΔT
			3.36	3.36	2.73	2.73					3.92	3.92	2.54	2.54	2.65	2.65			2.75	2.75	4.28	4.28	3.03	3.03	2.69	2.69	2.90	2.90	2.96	2.96	U
MSL																															ΔT
																															U
NIM			5.49	5.49	0.80	0.80	-0.72	-0.72					3.16	3.16	2.29	2.29			5.08	5.08	1.51	1.51	4.20	4.20	4.30	4.30	2.86	2.86	2.75	2.75	ΔT
			3.76	3.76	3.21	3.21	3.92	3.92					3.04	3.04	3.13	3.13			3.22	3.22	4.60	4.60	3.46	3.46	3.17	3.17	3.35	3.35	3.41	3.41	U
NIST			2.33	2.33	-2.36	-2.36	-3.88	-3.88			-3.16	-3.16			-0.87	-0.87			1.93	1.93	-1.64	-1.64	1.04	1.04	1.14	1.14	-0.29	-0.29	-0.41	-0.41	ΔT
			2.25	2.25	1.10	1.10	2.54	2.54			3.04	3.04			0.95	0.95			1.13	1.13	3.50	3.50	1.71	1.71	0.99	0.99	1.47	1.47	1.59	1.59	U
NML			3.20	3.20	-1.49	-1.49	-3.01	-3.01			-2.29	-2.29	0.87	0.87					2.80	2.80	-0.77	-0.77	1.91	1.91	2.01	2.01	0.57	0.57	0.46	0.46	ΔT
			2.40	2.40	1.38	1.38	2.65	2.65			3.13	3.13	0.95	0.95					1.41	1.41	3.50	3.50	1.90	1.90	1.30	1.30	1.69	1.69	1.80	1.80	U
NPL																															ΔT
																															U
NRC			0.41	0.41	-4.29	-4.29	-5.81	-5.81			-5.08	-5.08	-1.93	-1.93	-2.80	-2.80					-3.57	-3.57	-0.88	-0.88	-0.78	-0.78	-2.22	-2.22	-2.33	-2.33	ΔT
			2.48	2.48	1.49	1.49	2.75	2.75			3.22	3.22	1.13	1.13	1.41	1.41					3.65	3.65	2.00	2.00	1.44	1.44	1.80	1.80	1.90	1.90	U
NRLM			3.98	3.98	-0.72	-0.72	-2.24	-2.24			-1.51	-1.51	1.64	1.64	0.77	0.77			3.57	3.57			2.69	2.69	2.78	2.78	1.35	1.35	1.23	1.23	ΔT
			4.13	4.13	3.64	3.64	4.28	4.28			4.60	4.60	3.50	3.50	3.50	3.50			3.65	3.65			3.87	3.87	3.61	3.61	3.76	3.76	3.81	3.81	U
PTB			0.29	1.29	-3.40	-3.40	-4.92	-4.92			-4.20	-4.20	-1.04	-1.04	-1.91	-1.91			0.88	0.88	-2.69	-2.69			-0.51	0.10	-4.56	-1.34	-1.45	-1.45	ΔT
			2.76	2.78	1.98	1.98	3.03	3.03			3.46	3.46	1.71	1.71	1.90	1.90			2.00	2.00	3.87	3.87			1.89	1.91	2.17	2.20	2.29	2.29	U
SMU			0.60	1.19	-3.50	-3.50	-5.02	-5.02			-4.30	-4.30	-1.14	-1.14	-2.01	-2.01			0.78	0.78	-2.78	-2.78	0.51	-0.10			-4.04	-1.44	-1.55	-1.55	ΔT
			2.43	2.41	1.41	1.41	2.69	2.69			3.17	3.17	0.99	0.99	1.30	1.30			1.44	1.44	3.61	3.61	1.89	1.91			1.74	1.69	1.82	1.82	U
VNIIM			4.64	2.63	-2.06	-2.06	-3.58	-3.58			-2.86	-2.86	0.29	0.29	-0.57	-0.57			2.22	2.22	-1.35	-1.35	4.56	1.34	4.04	1.44			-0.11	-0.11	ΔT
			2.61	2.63	1.78	1.78	2.90	2.90			3.35	3.35	1.47	1.47	1.69	1.69			1.80	1.80	3.76	3.76	2.17	2.20	1.74	1.69			2.12	2.12	U
VSL			2.74	2.74	-1.95	-1.95	-3.47	-3.47			-2.75	-2.75	0.41	0.41	-0.46	-0.46			2.33	2.33	-1.23	-1.23	1.45	1.45	1.55	1.55	0.11	0.11			ΔT
			2.72	2.72	1.88	1.88	2.96	2.96			3.41	3.41	1.59	1.59	1.80	1.80			1.90	1.90	3.81	3.81	2.29	2.29	1.82	1.82	2.12	2.12			U

Table 22. Summary of differences of realizations and of their expanded uncertainties U (95 %) between laboratories for Zn, where ΔT/mK = column – row. U is expressed in mK. For information on why dir. and inc. values are different, see Section 5.2.

	BIPM		BNM		IMGC		KRISS		MSL		NIM		NIST		NML		NPL		NRC		NRLM		PTB		SMU		VNIIM		VSL		
	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	
BIPM																															ΔT
																															U
BNM					-1.29	-1.29	-1.02	-1.02	-0.74	-0.74	0.34	0.34	0.01	0.01	-0.57	-0.57	0.07	-0.13	-1.14	-1.14	-2.42	-2.42	-0.51	-1.17	-0.39	-0.46	-2.61	0.04	-0.30	-0.30	ΔT
					1.33	1.33	1.67	1.67	5.51	5.51	1.54	1.54	1.01	1.01	1.07	1.07	1.35	1.32	1.14	1.14	2.29	2.29	1.59	1.61	1.33	1.26	1.75	1.72	1.38	1.38	U
IMGC			1.29	1.29			0.26	0.26	0.55	0.55	1.63	1.63	1.30	1.30	0.72	0.72	1.16	1.16	0.15	0.15	-1.13	-1.13	0.12	0.12	0.83	0.83	1.33	1.33	0.99	0.99	ΔT
			1.33	1.33			1.61	1.61	5.50	5.50	1.47	1.47	0.91	0.91	0.98	0.98	1.25	1.25	1.04	1.04	2.25	2.25	1.55	1.55	1.19	1.19	1.67	1.67	1.31	1.31	U
KRISS			1.02	1.02	-0.26	-0.26			0.29	0.29	1.37	1.37	1.04	1.04	0.37	0.45	0.90	0.90	-0.12	-0.12	-1.48	-1.40	-0.15	-0.15	0.56	0.56	1.06	1.06	0.73	0.73	ΔT
			1.67	1.67	1.61	1.61			5.59	5.59	1.77	1.77	1.36	1.36	1.40	1.40	1.61	1.61	1.47	1.47	2.46	2.46	1.86	1.86	1.57	1.57	1.96	1.96	1.66	1.66	U
MSL			0.74	0.74	-0.55	-0.55	-0.29	-0.29			1.08	1.08	0.75	0.75	0.25	0.17	0.61	0.61	-0.40	-0.40	-1.60	-1.68	-0.43	-0.43	0.28	0.28	0.78	0.78	0.44	0.44	ΔT
			5.51	5.51	5.50	5.50	5.59	5.59			5.55	5.55	5.43	5.43	5.44	5.44	5.49	5.49	5.45	5.45	5.81	5.80	5.57	5.57	5.48	5.48	5.61	5.61	5.51	5.51	U
NIM			-0.34	-0.34	-1.63	-1.63	-1.37	-1.37	-1.08	-1.08			-0.33	-0.33	-1.00	-0.92	-0.47	-0.47	-1.48	-1.48	-2.85	-2.77	-1.52	-1.52	-0.81	-0.81	-0.31	-0.31	-0.64	-0.64	ΔT
			1.54	1.54	1.47	1.47	1.77	1.77	5.55	5.55			1.19	1.19	1.23	1.24	1.47	1.47	1.31	1.31	2.37	2.37	1.74	1.74	1.42	1.42	1.84	1.84	1.52	1.52	U
NIST			-0.01	-0.01	-1.30	-1.30	-1.04	-1.04	-0.75	-0.75	0.33	0.33			-0.59	-0.59	-0.14	-0.14	-1.15	-1.15	-2.44	-2.44	-1.19	-1.19	-0.47	-0.47	0.02	0.02	-0.31	-0.31	ΔT
			1.01	1.01	0.91	0.91	1.36	1.36	5.43	5.43	1.19	1.19			0.46	0.46	0.90	0.90	0.61	0.61	2.08	2.08	1.29	1.29	0.82	0.82	1.43	1.43	0.98	0.98	U
NML			0.57	0.57	-0.72	-0.72	-0.37	-0.45	-0.25	-0.17	1.00	0.92	0.59	0.59			0.45	0.45	-0.57	-0.57	-1.85	-1.85	-0.60	-0.60	0.11	0.11	0.61	0.61	0.28	0.28	ΔT
			1.07	1.07	0.98	0.98	1.40	1.40	5.44	5.44	1.23	1.24	0.46	0.46			0.98	0.98	0.71	0.71	2.09	2.09	1.35	1.35	0.90	0.90	1.48	1.48	1.05	1.05	U
NPL			-0.07	0.13	-1.16	-1.16	-0.90	-0.90	-0.61	-0.61	0.47	0.47	0.14	0.14	-0.45	-0.45			-1.01	-1.01	-2.29	-2.29	-0.47	-1.04	-0.33	-0.33	-2.69	0.17	-0.17	-0.17	ΔT
			1.35	1.32	1.25	1.25	1.61	1.61	5.49	5.49	1.47	1.47	0.90	0.90	0.98	0.98			1.05	1.05	2.25	2.25	1.53	1.54	1.16	1.16	1.65	1.66	1.31	1.31	U
NRC			1.14	1.14	-0.15	-0.15	0.12	0.12	0.40	0.40	1.48	1.48	1.15	1.15	0.57	0.57	1.01	1.01			-1.28	-1.28	-0.03	-0.03	0.68	0.68	1.18	1.18	0.84	0.84	ΔT
			1.14	1.14	1.04	1.04	1.47	1.47	5.45	5.45	1.31	1.31	0.61	0.61	0.71	0.71	1.05	1.05			2.15	2.15	1.40	1.40	0.98	0.98	1.53	1.53	1.12	1.12	U
NRLM			2.42	2.42	1.13	1.13	1.48	1.40	1.60	1.68	2.85	2.77	2.44	2.44	1.85	1.85	2.29	2.29	1.28	1.28			1.25	1.25	1.96	1.96	2.46	2.46	2.12	2.12	ΔT
			2.29	2.29	2.25	2.25	2.46	2.46	5.81	5.80	2.37	2.37	2.08	2.08	2.09	2.09	2.25	2.25	2.15	2.15			2.43	2.43	2.22	2.22	2.51	2.51	2.28	2.28	U
PTB			0.51	1.17	-0.12	-0.12	0.15	0.15	0.43	0.43	1.52	1.52	1.19	1.19	0.60	0.60	0.47	1.04	0.03	0.03	-1.25	-1.25			0.13	0.71	-1.27	1.21	0.87	0.87	ΔT
			1.59	1.61	1.55	1.55	1.86	1.86	5.57	5.57	1.74	1.74	1.29	1.29	1.35	1.35	1.53	1.54	1.40	1.40	2.43	2.43			1.49	1.50	1.89	1.91	1.60	1.60	U
SMU			0.39	0.46	-0.83	-0.83	-0.56	-0.56	-0.28	-0.28	0.81	0.81	0.47	0.47	-0.11	-0.11	0.33	0.33	-0.68	-0.68	-1.96	-1.96	-0.13	-0.71			-2.22	0.50	0.16	0.16	ΔT
			1.33	1.26	1.19	1.19	1.57	1.57	5.48	5.48	1.42	1.42	0.82	0.82	0.90	0.90	1.16	1.16	0.98	0.98	2.22	2.22	1.49	1.50			1.64	1.62	1.25	1.25	U
VNIIM			2.61	-0.04	-1.33	-1.33	-1.06	-1.06	-0.78	-0.78	0.31	0.31	-0.02	-0.02	-0.61	-0.61	2.69	-0.17	-1.18	-1.18	-2.46	-2.46	1.27	-1.21	2.22	-0.50			-0.33	-0.33	ΔT
			1.75	1.72	1.67	1.67	1.96	1.96	5.61	5.61	1.84	1.84	1.43	1.43	1.48	1.48	1.65	1.66	1.53	1.53	2.51	2.51	1.89	1.91	1.64	1.62			1.71	1.71	U
VSL			0.30	0.30	-0.99	-0.99	-0.73	-0.73	-0.44	-0.44	0.64	0.64	0.31	0.31	-0.28	-0.28	0.17	0.17	-0.84	-0.84	-2.12	-2.12	-0.87	-0.87	-0.16	-0.16	0.33	0.33			ΔT
			1.38	1.38	1.31	1.31	1.66	1.66	5.51	5.51	1.52	1.52	0.98	0.98	1.05	1.05	1.31	1.31	1.12	1.12	2.28	2.28	1.60	1.60	1.25	1.25	1.71	1.71			U

Table 23. Summary of differences of realizations and of their expanded uncertainties U (95 %) between laboratories for Cd, where ΔT/mK = column – row. U is expressed in mK. For information on why dir. and inc. values are different, see Section 5.2.

	BIPM		**BNM**		**IMGC**		**KRISS**		**MSL**		**NIM**		**NIST**		**NML**		**NPL**		**NRC**		**NRLM**		**PTB**		**SMU**		**VNIIM**		**VSL**		
	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	
BIPM																															ΔT
																															U
BNM																															ΔT
																															U
IMGC											2.75	2.75	1.47	1.47	0.26	0.26			0.51	0.51							1.87	1.87			ΔT
											2.07	2.07	0.66	0.66	0.77	0.77			0.77	0.77							1.60	1.60			U
KRISS																															ΔT
																															U
MSL																															ΔT
																															U
NIM					-2.75	-2.75							-1.28	-1.28	-2.83	-2.49			-2.24	-2.24							-0.89	-0.89			ΔT
					2.07	2.07							1.96	1.96	1.99	2.00			2.01	2.01							2.44	2.44			U
NIST					-1.47	-1.47					1.28	1.28			-1.21	-1.21			-0.95	-0.95							0.40	0.40			ΔT
					0.66	0.66					1.96	1.96			0.41	0.41			0.42	0.42							1.46	1.46			U
NML					-0.26	-0.26					2.83	2.49	1.21	1.21					0.26	0.26							1.61	1.61			ΔT
					0.77	0.77					1.99	2.00	0.41	0.41					0.58	0.58							1.51	1.51			U
NPL																															ΔT
																															U
NRC					-0.51	-0.51					2.24	2.24	0.95	0.95	-0.26	-0.26											1.35	1.35			ΔT
					0.77	0.77					2.01	2.01	0.42	0.42	0.58	0.58											1.51	1.51			U
NRLM																															ΔT
																															U
PTB																															ΔT
																															U
SMU																															ΔT
																															U
VNIIM					-1.87	-1.87					0.89	0.89	-0.40	-0.40	-1.61	-1.61			-1.35	-1.35											ΔT
					1.60	1.60					2.44	2.44	1.46	1.46	1.51	1.51			1.51	1.51											U
VSL																															ΔT
																															U

Table 24. Summary of differences of realizations and of their expanded uncertainties U (95 %) between laboratories for Sn, where ΔT/mK = column – row. U is expressed in mK. For information on why dir. and inc. values are different, see Section 5.2.

	BIPM		BNM		IMGC		KRISS		MSL		NIM		NIST		NML		NPL		NRC		NRLM		PTB		SMU		VNIIM		VSL		
	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	
BIPM																															ΔT
																															U
BNM					0.37	0.37	-0.02	-0.02	-0.34	-0.34	-0.68	-0.68	0.50	0.50	-0.64	-0.64	-0.66	0.23	-0.85	-0.85	-0.70	-0.70	0.60	0.71	0.47	0.37	0.27	0.71	0.07	0.07	ΔT
					1.04	1.04	1.39	1.39	1.51	1.51	5.73	5.73	0.94	0.94	1.00	1.00	1.19	1.18	1.21	1.21	1.28	1.28	1.26	1.27	1.32	1.27	1.18	1.17	1.19	1.19	U
IMGC			-0.37	-0.37			-0.40	-0.40	-0.71	-0.71	-1.05	-1.05	0.13	0.13	-1.01	-1.01	-0.14	-0.14	-1.22	-1.22	-1.07	-1.07	0.33	0.33	0.00	0.00	0.33	0.33	-0.30	-0.30	ΔT
			1.04	1.04			1.12	1.12	1.26	1.26	5.67	5.67	0.44	0.44	0.57	0.57	0.84	0.84	0.88	0.88	0.98	0.98	0.97	0.97	0.97	0.97	0.84	0.84	0.86	0.86	U
KRISS			0.02	0.02	0.40	0.40			-0.31	-0.31	-0.65	-0.65	0.53	0.53	-0.86	-0.61	0.26	0.26	-0.82	-0.82	-0.93	-0.68	0.73	0.73	0.39	0.39	0.73	0.73	0.10	0.10	ΔT
			1.39	1.39	1.12	1.12			1.56	1.56	5.74	5.74	1.03	1.03	1.06	1.08	1.25	1.25	1.28	1.28	1.33	1.34	1.34	1.34	1.34	1.34	1.25	1.25	1.26	1.26	U
MSL			0.34	0.34	0.71	0.71	0.31	0.31			-0.34	-0.34	0.84	0.84	-0.05	-0.30	0.57	0.57	-0.51	-0.51	-0.11	-0.36	1.04	1.04	0.71	0.71	1.04	1.04	0.41	0.41	ΔT
			1.51	1.51	1.26	1.26	1.56	1.56			5.77	5.77	1.18	1.18	1.22	1.23	1.38	1.38	1.41	1.41	1.46	1.47	1.46	1.46	1.46	1.46	1.38	1.38	1.39	1.39	U
NIM			0.68	0.68	1.05	1.05	0.65	0.65	0.34	0.34			1.18	1.18	-0.21	0.04	0.91	0.91	-0.17	-0.17	-0.27	-0.02	1.38	1.38	1.05	1.05	1.38	1.38	0.75	0.75	ΔT
			5.73	5.73	5.67	5.67	5.74	5.74	5.77	5.77			5.65	5.65	5.66	5.66	5.70	5.70	5.70	5.70	5.71	5.72	5.72	5.72	5.72	5.72	5.70	5.70	5.70	5.70	U
NIST			-0.50	-0.50	-0.13	-0.13	-0.53	-0.53	-0.84	-0.84	-1.18	-1.18			-1.14	-1.14	-0.27	-0.27	-1.35	-1.35	-1.20	-1.20	0.20	0.20	-0.13	-0.13	0.20	0.20	-0.43	-0.43	ΔT
			0.94	0.94	0.44	0.44	1.03	1.03	1.18	1.18	5.65	5.65			0.36	0.36	0.72	0.72	0.76	0.76	0.88	0.88	0.86	0.86	0.86	0.86	0.71	0.71	0.74	0.74	U
NML			0.64	0.64	1.01	1.01	0.86	0.61	0.05	0.30	0.21	-0.04	1.14	1.14			0.87	0.87	-0.21	-0.21	-0.06	-0.06	1.34	1.34	1.01	1.01	1.34	1.34	0.71	0.71	ΔT
			1.00	1.00	0.57	0.57	1.06	1.08	1.22	1.23	5.66	5.66	0.36	0.36			0.80	0.80	0.84	0.84	0.90	0.90	0.93	0.93	0.93	0.93	0.79	0.79	0.82	0.82	U
NPL			0.66	-0.23	0.14	0.14	-0.26	-0.26	-0.57	-0.57	-0.91	-0.91	0.27	0.27	-0.87	-0.87			-1.08	-1.08	-0.93	-0.93	0.60	0.47	0.14	0.14	0.93	0.47	-0.16	-0.16	ΔT
			1.19	1.18	0.84	0.84	1.25	1.25	1.38	1.38	5.70	5.70	0.72	0.72	0.80	0.80			1.05	1.05	1.13	1.13	1.11	1.11	1.10	1.10	1.00	1.00	1.03	1.03	U
NRC			0.85	0.85	1.22	1.22	0.82	0.82	0.51	0.51	0.17	0.17	1.35	1.35	0.21	0.21	1.08	1.08			0.15	0.15	1.55	1.55	1.22	1.22	1.55	1.55	0.92	0.92	ΔT
			1.21	1.21	0.88	0.88	1.28	1.28	1.41	1.41	5.70	5.70	0.76	0.76	0.84	0.84	1.05	1.05			1.16	1.16	1.15	1.15	1.15	1.15	1.04	1.04	1.06	1.06	U
NRLM			0.70	0.70	1.07	1.07	0.93	0.68	0.11	0.36	0.27	0.02	1.20	1.20	0.06	0.06	0.93	0.93	-0.15	-0.15			1.41	1.41	1.07	1.07	1.41	1.41	0.77	0.77	ΔT
			1.28	1.28	0.98	0.98	1.33	1.34	1.46	1.47	5.71	5.72	0.88	0.88	0.90	0.90	1.13	1.13	1.16	1.16			1.23	1.23	1.23	1.23	1.13	1.13	1.15	1.15	U
PTB			-0.60	-0.71	-0.33	-0.33	-0.73	-0.73	-1.04	-1.04	-1.38	-1.38	-0.20	-0.20	-1.34	-1.34	-0.60	-0.47	-1.55	-1.55	-1.41	-1.41			-0.46	-0.34	-0.04	0.00	-0.63	-0.63	ΔT
			1.26	1.27	0.97	0.97	1.34	1.34	1.46	1.46	5.72	5.72	0.86	0.86	0.93	0.93	1.11	1.11	1.15	1.15	1.23	1.23			1.21	1.21	1.10	1.11	1.14	1.14	U
SMU			-0.47	-0.37	0.00	0.00	-0.39	-0.39	-0.71	-0.71	-1.05	-1.05	0.13	0.13	-1.01	-1.01	-0.14	-0.14	-1.22	-1.22	-1.07	-1.07	0.46	0.34			-0.21	0.34	-0.30	-0.30	ΔT
			1.32	1.27	0.97	0.97	1.34	1.34	1.46	1.46	5.72	5.72	0.86	0.86	0.93	0.93	1.10	1.10	1.15	1.15	1.23	1.23	1.21	1.21			1.15	1.11	1.14	1.14	U
VNIIM			-0.27	-0.71	-0.33	-0.33	-0.73	-0.73	-1.04	-1.04	-1.38	-1.38	-0.20	-0.20	-1.34	-1.34	-0.93	-0.47	-1.55	-1.55	-1.41	-1.41	0.04	0.00	0.21	-0.34			-0.63	-0.63	ΔT
			1.18	1.17	0.84	0.84	1.25	1.25	1.38	1.38	5.70	5.70	0.71	0.71	0.79	0.79	1.00	1.00	1.04	1.04	1.13	1.13	1.10	1.11	1.15	1.11			1.02	1.02	U
VSL			-0.07	-0.07	0.30	0.30	-0.10	-0.10	-0.41	-0.41	-0.75	-0.75	0.43	0.43	-0.71	-0.71	0.16	0.16	-0.92	-0.92	-0.77	-0.77	0.63	0.63	0.30	0.30	0.63	0.63			ΔT
			1.19	1.19	0.86	0.86	1.26	1.26	1.39	1.39	5.70	5.70	0.74	0.74	0.82	0.82	1.03	1.03	1.06	1.06	1.15	1.15	1.14	1.14	1.14	1.14	1.02	1.02			U

Table 25. Summary of differences of realizations and of their expanded uncertainties U (95 %) between laboratories for In, where ΔT/mK = column – row. U is expressed in mK. For information on why dir. and inc. values are different, see Section 5.2.

	BIPM		BNM		IMGC		KRISS		MSL		NIM		NIST		NML		NPL		NRC		NRLM		PTB		SMU		VNIIM		VSL		
	dir.	inc.	dir.	inc	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	
BIPM																															ΔT
																															U
BNM					0.37	0.37	1.96	1.96	0.23	0.23	-0.98	-0.98	0.63	0.63	-1.01	-1.01	-0.59	-0.05	-0.40	-0.40	-0.37	-0.37	0.10	0.32			1.07	0.75	-0.58	-0.58	ΔT
					0.89	0.89	0.98	0.98	1.06	1.06	1.13	1.13	0.64	0.64	1.04	1.04	0.93	0.92	0.71	0.71	1.15	1.15	1.28	1.28			0.95	0.96	0.92	0.92	U
IMGC			-0.37	-0.37			1.59	1.59	-0.14	-0.14	-1.35	-1.35	0.26	0.26	-1.39	-1.39	-0.42	-0.42	-0.77	-0.77	-0.74	-0.74	-0.05	-0.05			0.38	0.38	-0.96	-0.96	ΔT
			0.89	0.89			0.97	0.97	1.06	1.06	1.13	1.13	0.63	0.63	1.03	1.03	0.91	0.91	0.70	0.70	1.14	1.14	1.28	1.28			0.95	0.95	0.91	0.91	U
KRISS			-1.96	-1.96	-1.59	-1.59			-1.73	-1.73	-2.94	-2.94	-1.33	-1.33	-3.54	-2.98	-2.02	-2.02	-2.36	-2.36	-2.89	-2.33	-1.64	-1.64			-1.22	-1.22	-2.55	-2.55	ΔT
			0.98	0.98	0.97	0.97			1.13	1.13	1.20	1.20	0.75	0.75	1.11	1.11	1.00	1.00	0.81	0.81	1.21	1.21	1.34	1.34			1.03	1.03	1.00	1.00	U
MSL			-0.23	-0.23	0.14	0.14	1.73	1.73			-1.21	-1.21	0.40	0.40	-0.69	-1.25	-0.28	-0.28	-0.63	-0.63	-0.04	-0.60	0.09	0.09			0.52	0.52	-0.81	-0.81	ΔT
			1.06	1.06	1.06	1.06	1.13	1.13			1.27	1.27	0.85	0.85	1.18	1.18	1.08	1.08	0.91	0.91	1.28	1.28	1.40	1.40			1.11	1.11	1.08	1.08	U
NIM			0.98	0.98	1.35	1.35	2.94	2.94	1.21	1.21			1.61	1.61	-0.60	-0.04	0.92	0.92	0.58	0.58	0.05	0.61	1.30	1.30			1.72	1.72	0.39	0.39	ΔT
			1.13	1.13	1.13	1.13	1.20	1.20	1.27	1.27			0.94	0.94	1.24	1.25	1.15	1.15	0.99	0.99	1.34	1.34	1.46	1.46			1.18	1.18	1.15	1.15	U
NIST			-0.63	-0.63	-0.26	-0.26	1.33	1.33	-0.40	-0.40	-1.61	-1.61			-1.65	-1.65	-0.68	-0.68	-1.03	-1.03	-1.00	-1.00	-0.31	-0.31			0.11	0.11	-1.22	-1.22	ΔT
			0.64	0.64	0.63	0.63	0.75	0.75	0.85	0.85	0.94	0.94			0.82	0.82	0.67	0.67	0.32	0.32	0.96	0.96	1.12	1.12			0.72	0.72	0.67	0.67	U
NML			1.01	1.01	1.39	1.39	3.54	2.98	0.69	1.25	0.60	0.04	1.65	1.65			0.96	0.96	0.62	0.62	0.65	0.65	1.34	1.34			1.76	1.76	0.43	0.43	ΔT
			1.04	1.04	1.03	1.03	1.11	1.11	1.18	1.18	1.24	1.25	0.82	0.82			1.06	1.06	0.88	0.88	1.26	1.26	1.38	1.38			1.09	1.09	1.06	1.06	U
NPL			0.59	0.05	0.42	0.42	2.02	2.02	0.28	0.28	-0.92	-0.92	0.68	0.68	-0.96	-0.96			-0.35	-0.35	-0.32	-0.32	0.20	0.37			1.66	0.80	-0.53	-0.53	ΔT
			0.93	0.92	0.91	0.91	1.00	1.00	1.08	1.08	1.15	1.15	0.67	0.67	1.06	1.06			0.74	0.74	1.17	1.17	1.30	1.30			0.98	0.98	0.94	0.94	U
NRC			0.40	0.40	0.77	0.77	2.36	2.36	0.63	0.63	-0.58	-0.58	1.03	1.03	-0.62	-0.62	0.35	0.35			0.03	0.03	0.72	0.72			1.15	1.15	-0.18	-0.18	ΔT
			0.71	0.71	0.70	0.70	0.81	0.81	0.91	0.91	0.99	0.99	0.32	0.32	0.88	0.88	0.74	0.74			1.01	1.01	1.16	1.16			0.78	0.78	0.73	0.73	U
NRLM			0.37	0.37	0.74	0.74	2.89	2.33	0.04	0.60	-0.05	-0.61	1.00	1.00	-0.65	-0.65	0.32	0.32	-0.03	-0.03			0.69	0.69			1.12	1.12	-0.22	-0.22	ΔT
			1.15	1.15	1.14	1.14	1.21	1.21	1.28	1.28	1.34	1.34	0.96	0.96	1.26	1.26	1.17	1.17	1.01	1.01			1.47	1.47			1.20	1.20	1.17	1.17	U
PTB			-0.10	-0.32	0.05	0.05	1.64	1.64	-0.09	-0.09	-1.30	-1.30	0.31	0.31	-1.34	-1.34	-0.20	-0.37	-0.72	-0.72	-0.69	-0.69					1.21	0.43	-0.91	-0.91	ΔT
			1.28	1.28	1.28	1.28	1.34	1.34	1.40	1.40	1.46	1.46	1.12	1.12	1.38	1.38	1.30	1.30	1.16	1.16	1.47	1.47					1.32	1.32	1.30	1.30	U
SMU																															ΔT
																															U
VNIIM			-1.07	-0.75	-0.38	-0.38	1.22	1.22	-0.52	-0.52	-1.72	-1.72	-0.11	-0.11	-1.76	-1.76	-1.66	-0.80	-1.15	-1.15	-1.12	-1.12	-1.21	-0.43					-1.33	-1.33	ΔT
			0.95	0.96	0.95	0.95	1.03	1.03	1.11	1.11	1.18	1.18	0.72	0.72	1.09	1.09	0.98	0.98	0.78	0.78	1.20	1.20	1.32	1.32					0.97	0.97	U
VSL			0.58	0.58	0.96	0.96	2.55	2.55	0.81	0.81	-0.39	-0.39	1.22	1.22	-0.43	-0.43	0.53	0.53	0.18	0.18	0.22	0.22	0.91	0.91			1.33	1.33			ΔT
			0.92	0.92	0.91	0.91	1.00	1.00	1.08	1.08	1.15	1.15	0.67	0.67	1.06	1.06	0.94	0.94	0.73	0.73	1.17	1.17	1.30	1.30			0.97	0.97			U

Table 26. Summary of differences of realizations and of their expanded uncertainties U (95 %) between laboratories for Ga, where ΔT/mK = column – row. U is expressed in mK. For information on why dir. and inc. values are different, see Section 5.2.

	BIPM		BNM		IMGC		KRISS		MSL		NIM		NIST		NML		NPL		NRC		NRLM		PTB		SMU		VNIIM		VSL		
	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	
BIPM			0.11	0.06	0.18	0.18	0.09	0.09	0.26	0.26	-0.50	-0.50	0.09	0.09	-0.07	-0.07	-0.08	-0.08	-0.05	-0.05	-0.28	-0.28	0.24	0.30	0.13	0.13	0.46	0.10	-0.13	-0.13	ΔT
			0.34	0.33	0.20	0.20	0.48	0.48	0.39	0.39	0.59	0.59	0.16	0.16	0.30	0.30	0.45	0.45	0.31	0.31	0.27	0.27	0.29	0.29	0.24	0.24	0.25	0.24	0.44	0.44	U
BNM	-0.11	-0.06			0.11	0.11	0.02	0.02	0.20	0.20	-0.56	-0.56	0.03	0.03	-0.14	-0.14	-0.14	-0.14	-0.11	-0.11	-0.34	-0.34	0.08	0.23	0.18	0.07	0.35	0.04	-0.20	-0.20	ΔT
	0.34	0.33			0.32	0.32	0.54	0.54	0.46	0.46	0.64	0.64	0.29	0.29	0.39	0.39	0.54	0.51	0.40	0.40	0.37	0.37	0.38	0.38	0.35	0.35	0.34	0.34	0.50	0.50	U
IMGC	-0.18	-0.18	-0.11	-0.11			-0.09	-0.09	0.08	0.08	-0.68	-0.68	-0.09	-0.09	-0.25	-0.25	-0.25	-0.25	-0.23	-0.23	-0.46	-0.46	0.12	0.12	-0.05	-0.05	-0.08	-0.08	-0.31	-0.31	ΔT
	0.20	0.20	0.32	0.32			0.47	0.47	0.38	0.38	0.59	0.59	0.13	0.13	0.29	0.29	0.44	0.44	0.30	0.30	0.26	0.26	0.27	0.27	0.23	0.23	0.23	0.23	0.43	0.43	U
KRISS	-0.09	-0.09	-0.02	-0.02	0.09	0.09			0.17	0.17	-0.59	-0.59	0.00	0.00	-0.29	-0.16	-0.16	-0.16	-0.13	-0.13	-0.50	-0.37	0.21	0.21	0.04	0.04	0.01	0.01	-0.22	-0.22	ΔT
	0.48	0.48	0.54	0.54	0.47	0.47			0.58	0.58	0.73	0.73	0.46	0.46	0.52	0.52	0.62	0.62	0.53	0.53	0.51	0.51	0.52	0.52	0.50	0.50	0.49	0.49	0.62	0.62	U
MSL	-0.26	-0.26	-0.20	-0.20	-0.08	-0.08	-0.17	-0.17			-0.76	-0.76	-0.17	-0.17	-0.20	-0.33	-0.34	-0.34	-0.31	-0.31	-0.41	-0.54	0.03	0.03	-0.13	-0.13	-0.16	-0.16	-0.40	-0.40	ΔT
	0.39	0.39	0.46	0.46	0.38	0.38	0.58	0.58			0.68	0.68	0.36	0.36	0.44	0.44	0.55	0.55	0.45	0.45	0.42	0.42	0.43	0.43	0.41	0.41	0.40	0.40	0.55	0.55	U
NIM	0.50	0.50	0.56	0.56	0.68	0.68	0.59	0.59	0.76	0.76			0.59	0.59	0.30	0.43	0.43	0.43	0.45	0.45	0.09	0.22	0.80	0.80	0.63	0.63	0.60	0.60	0.37	0.37	ΔT
	0.59	0.59	0.64	0.64	0.59	0.59	0.73	0.73	0.68	0.68			0.57	0.57	0.62	0.63	0.71	0.71	0.63	0.63	0.61	0.61	0.62	0.62	0.60	0.60	0.60	0.60	0.70	0.70	U
NIST	-0.09	-0.09	-0.03	-0.03	0.09	0.09	0.00	0.00	0.17	0.17	-0.59	-0.59			-0.16	-0.16	-0.17	-0.17	-0.14	-0.14	-0.37	-0.37	0.20	0.20	0.04	0.04	0.01	0.01	-0.23	-0.23	ΔT
	0.16	0.16	0.29	0.29	0.13	0.13	0.46	0.46	0.36	0.36	0.57	0.57			0.26	0.26	0.42	0.42	0.27	0.27	0.22	0.22	0.24	0.24	0.19	0.19	0.19	0.19	0.41	0.41	U
NML	0.07	0.07	0.14	0.14	0.25	0.25	0.29	0.16	0.20	0.33	-0.30	-0.43	0.16	0.16			0.00	0.00	0.02	0.02	-0.21	-0.21	0.37	0.37	0.20	0.20	0.17	0.17	-0.06	-0.06	ΔT
	0.30	0.30	0.39	0.39	0.29	0.29	0.52	0.52	0.44	0.44	0.62	0.63	0.26	0.26			0.49	0.49	0.37	0.37	0.33	0.33	0.35	0.35	0.32	0.32	0.32	0.32	0.48	0.48	U
NPL	0.08	0.08	0.14	0.14	0.25	0.25	0.16	0.16	0.34	0.34	-0.43	-0.43	0.17	0.17	0.00	0.00			0.03	0.03	-0.21	-0.21	0.31	0.37	0.21	0.21	0.49	0.18	-0.06	-0.06	ΔT
	0.45	0.45	0.54	0.51	0.44	0.44	0.62	0.62	0.55	0.55	0.71	0.71	0.42	0.42	0.49	0.49			0.50	0.50	0.48	0.48	0.48	0.48	0.46	0.46	0.49	0.46	0.59	0.59	U
NRC	0.05	0.05	0.11	0.11	0.23	0.23	0.13	0.13	0.31	0.31	-0.45	-0.45	0.14	0.14	-0.02	-0.02	-0.03	-0.03			-0.23	-0.23	0.34	0.34	0.18	0.18	0.15	0.15	-0.09	-0.09	ΔT
	0.31	0.31	0.40	0.40	0.30	0.30	0.53	0.53	0.45	0.45	0.63	0.63	0.27	0.27	0.37	0.37	0.50	0.50			0.35	0.35	0.36	0.36	0.33	0.33	0.32	0.32	0.49	0.49	U
NRLM	0.28	0.28	0.34	0.34	0.46	0.46	0.50	0.37	0.41	0.54	-0.09	-0.22	0.37	0.37	0.21	0.21	0.21	0.21	0.23	0.23			0.58	0.58	0.41	0.41	0.38	0.38	0.15	0.15	ΔT
	0.27	0.27	0.37	0.37	0.26	0.26	0.51	0.51	0.42	0.42	0.61	0.61	0.22	0.22	0.33	0.33	0.48	0.48	0.35	0.35			0.33	0.33	0.29	0.29	0.29	0.29	0.47	0.47	U
PTB	-0.24	-0.30	-0.08	-0.23	-0.12	-0.12	-0.21	-0.21	-0.03	-0.03	-0.80	-0.80	-0.20	-0.20	-0.37	-0.37	-0.31	-0.37	-0.34	-0.34	-0.58	-0.58			-0.10	-0.16	0.22	-0.20	-0.43	-0.43	ΔT
	0.29	0.29	0.38	0.38	0.27	0.27	0.52	0.52	0.43	0.43	0.62	0.62	0.24	0.24	0.35	0.35	0.48	0.48	0.36	0.36	0.33	0.33			0.31	0.31	0.30	0.30	0.48	0.48	U
SMU	-0.13	-0.13	-0.18	-0.07	0.05	0.05	-0.04	-0.04	0.13	0.13	-0.63	-0.63	-0.04	-0.04	-0.20	-0.20	-0.21	-0.21	-0.18	-0.18	-0.41	-0.41	0.10	0.16			0.17	-0.03	-0.27	-0.27	ΔT
	0.24	0.24	0.35	0.35	0.23	0.23	0.50	0.50	0.41	0.41	0.60	0.60	0.19	0.19	0.32	0.32	0.46	0.46	0.33	0.33	0.29	0.29	0.31	0.31			0.27	0.26	0.45	0.45	U
VNIIM	-0.46	-0.10	-0.35	-0.04	0.08	0.08	-0.01	-0.01	0.16	0.16	-0.60	-0.60	-0.01	-0.01	-0.17	-0.17	-0.49	-0.18	-0.15	-0.15	-0.38	-0.38	-0.22	0.20	-0.17	0.03			-0.23	-0.23	ΔT
	0.25	0.24	0.34	0.34	0.23	0.23	0.49	0.49	0.40	0.40	0.60	0.60	0.19	0.19	0.32	0.32	0.49	0.46	0.32	0.32	0.29	0.29	0.30	0.30	0.27	0.26			0.45	0.45	U
VSL	0.13	0.13	0.20	0.20	0.31	0.31	0.22	0.22	0.40	0.40	-0.37	-0.37	0.23	0.23	0.06	0.06	0.06	0.06	0.09	0.09	-0.15	-0.15	0.43	0.43	0.27	0.27	0.23	0.23			ΔT
	0.44	0.44	0.50	0.50	0.43	0.43	0.62	0.62	0.55	0.55	0.70	0.70	0.41	0.41	0.48	0.48	0.59	0.59	0.49	0.49	0.47	0.47	0.48	0.48	0.45	0.45	0.45	0.45			U

Table 27. Summary of differences of realizations and of their expanded uncertainties U (95 %) between laboratories for Hg, where ΔT/mK = column – row. U is expressed in mK. For information on why dir. and inc. values are different, see Section 5.2.

	BIPM		BNM		IMGC		KRISS		MSL		NIM		NIST		NML		NPL		NRC		NRLM		PTB		SMU		VNIIM		VSL		
	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	
BIPM																															ΔT
																															U
BNM					0.29	0.29	0.87	0.87	0.63	0.63	0.58	0.58	0.37	0.37	0.32	0.32	0.57	0.48	0.59	0.59	0.27	0.27	0.45	0.32					0.41	0.41	ΔT
					0.62	0.62	0.73	0.73	0.70	0.70	0.76	0.76	0.57	0.57	0.62	0.62	0.69	0.68	0.59	0.59	0.81	0.81	0.63	0.63					0.70	0.70	U
IMGC			-0.29	-0.29			0.59	0.59	0.35	0.35	0.29	0.29	0.09	0.09	0.04	0.04	0.19	0.19	0.30	0.30	-0.02	-0.02	0.03	0.03					0.13	0.13	ΔT
			0.62	0.62			0.54	0.54	0.49	0.49	0.57	0.57	0.27	0.27	0.37	0.37	0.46	0.46	0.31	0.31	0.64	0.64	0.39	0.39					0.49	0.49	U
KRISS			-0.87	-0.87	-0.59	-0.59			-0.24	-0.24	-0.29	-0.29	-0.50	-0.50	-0.79	-0.55	-0.40	-0.40	-0.28	-0.28	-0.85	-0.61	-0.56	-0.56					-0.46	-0.46	ΔT
			0.73	0.73	0.54	0.54			0.62	0.62	0.68	0.68	0.47	0.47	0.52	0.53	0.60	0.60	0.50	0.50	0.74	0.74	0.54	0.54					0.62	0.62	U
MSL			-0.63	-0.63	-0.35	-0.35	0.24	0.24			-0.06	-0.06	-0.26	-0.26	-0.07	-0.31	-0.16	-0.16	-0.05	-0.05	-0.13	-0.37	-0.32	-0.32					-0.22	-0.22	ΔT
			0.70	0.70	0.49	0.49	0.62	0.62			0.65	0.65	0.41	0.41	0.47	0.47	0.55	0.55	0.44	0.44	0.71	0.71	0.50	0.50					0.58	0.58	U
NIM			-0.58	-0.58	-0.29	-0.29	0.29	0.29	0.06	0.06			-0.21	-0.21	-0.50	-0.26	-0.10	-0.10	0.01	0.01	-0.55	-0.31	-0.26	-0.26					-0.17	-0.17	ΔT
			0.76	0.76	0.57	0.57	0.68	0.68	0.65	0.65			0.51	0.51	0.56	0.56	0.63	0.63	0.53	0.53	0.77	0.77	0.58	0.58					0.65	0.65	U
NIST			-0.37	-0.37	-0.09	-0.09	0.50	0.50	0.26	0.26	0.21	0.21			-0.05	-0.05	0.11	0.11	0.22	0.22	-0.10	-0.10	-0.05	-0.05					0.04	0.04	ΔT
			0.57	0.57	0.27	0.27	0.47	0.47	0.41	0.41	0.51	0.51			0.25	0.25	0.37	0.37	0.17	0.17	0.59	0.59	0.28	0.28					0.41	0.41	U
NML			-0.32	-0.32	-0.04	-0.04	0.79	0.55	0.07	0.31	0.50	0.26	0.05	0.05			0.15	0.15	0.26	0.26	-0.06	-0.06	-0.01	-0.01					0.09	0.09	ΔT
			0.62	0.62	0.37	0.37	0.52	0.53	0.47	0.47	0.56	0.56	0.25	0.25			0.45	0.45	0.30	0.30	0.63	0.63	0.38	0.38					0.48	0.48	U
NPL			-0.57	-0.48	-0.19	-0.19	0.40	0.40	0.16	0.16	0.10	0.10	-0.11	-0.11	-0.15	-0.15			0.11	0.11	-0.21	-0.21	-0.24	-0.16					-0.06	-0.06	ΔT
			0.69	0.68	0.46	0.46	0.60	0.60	0.55	0.55	0.63	0.63	0.37	0.37	0.45	0.45			0.41	0.41	0.69	0.69	0.46	0.46					0.55	0.55	U
NRC			-0.59	-0.59	-0.30	-0.30	0.28	0.28	0.05	0.05	-0.01	-0.01	-0.22	-0.22	-0.26	-0.26	-0.11	-0.11			-0.32	-0.32	-0.27	-0.27					-0.17	-0.17	ΔT
			0.59	0.59	0.31	0.31	0.50	0.50	0.44	0.44	0.53	0.53	0.17	0.17	0.30	0.30	0.41	0.41			0.61	0.61	0.33	0.33					0.44	0.44	U
NRLM			-0.27	-0.27	0.02	0.02	0.85	0.61	0.13	0.37	0.55	0.31	0.10	0.10	0.06	0.06	0.21	0.21	0.32	0.32			0.05	0.05					0.15	0.15	ΔT
			0.81	0.81	0.64	0.64	0.74	0.74	0.71	0.71	0.77	0.77	0.59	0.59	0.63	0.63	0.69	0.69	0.61	0.61			0.65	0.65					0.71	0.71	U
PTB			-0.45	-0.32	-0.03	-0.03	0.56	0.56	0.32	0.32	0.26	0.26	0.05	0.05	0.01	0.01	0.24	0.16	0.27	0.27	-0.05	-0.05							0.10	0.10	ΔT
			0.63	0.63	0.39	0.39	0.54	0.54	0.50	0.50	0.58	0.58	0.28	0.28	0.38	0.38	0.46	0.46	0.33	0.33	0.65	0.65							0.50	0.50	U
SMU																															ΔT
																															U
VNIIM																															ΔT
																															U
VSL			-0.41	-0.41	-0.13	-0.13	0.46	0.46	0.22	0.22	0.17	0.17	-0.04	-0.04	-0.09	-0.09	0.06	0.06	0.17	0.17	-0.15	-0.15	-0.10	-0.10							ΔT
			0.70	0.70	0.49	0.49	0.62	0.62	0.58	0.58	0.65	0.65	0.41	0.41	0.48	0.48	0.55	0.55	0.44	0.44	0.71	0.71	0.50	0.50							U

Table 28. Summary of differences of realizations and of their expanded uncertainties U (95 %) between laboratories for Ar, where ΔT/mK = column – row. U is expressed in mK. For information on why dir. and inc. values are different, see Section 5.2.

	BIPM		BNM		IMGC		KRISS		MSL		NIM		NIST		NML		NPL		NRC		NRLM		PTB		SMU		VNIIM		VSL		
	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	dir.	inc.	
BIPM																															ΔT
																															U
BNM					1.08	1.08					0.11	0.11	0.35	0.35	-2.07	-2.07	-0.88	-0.66	0.45	0.45			0.06	0.12					0.29	0.29	ΔT
					0.78	0.78					0.88	0.88	0.58	0.58	1.12	1.12	0.94	0.89	0.65	0.65			0.79	0.79					0.87	0.87	U
IMGC			-1.08	-1.08							-0.97	-0.97	-0.73	-0.73	-3.15	-3.15	-1.74	-1.74	-0.63	-0.63			-0.96	-0.96					-0.79	-0.79	ΔT
			0.78	0.78							0.84	0.84	0.52	0.52	1.10	1.10	0.85	0.85	0.60	0.60			0.75	0.75					0.84	0.84	U
KRISS																															ΔT
																															U
MSL																															ΔT
																															U
NIM			-0.11	-0.11	0.97	0.97							0.24	0.24	-2.46	-2.18	-0.77	-0.77	0.34	0.34			0.01	0.01					0.18	0.18	ΔT
			0.88	0.88	0.84	0.84							0.66	0.66	1.17	1.17	0.95	0.95	0.73	0.73			0.86	0.86					0.93	0.93	U
NIST			-0.35	-0.35	0.73	0.73					-0.24	-0.24			-2.42	-2.42	-1.01	-1.01	0.10	0.10			-0.23	-0.23					-0.06	-0.06	ΔT
			0.58	0.58	0.52	0.52					0.66	0.66			0.97	0.97	0.68	0.68	0.31	0.31			0.55	0.55					0.66	0.66	U
NML			2.07	2.07	3.15	3.15					2.46	2.18	2.42	2.42			1.41	1.41	2.52	2.52			2.19	2.19					2.36	2.36	ΔT
			1.12	1.12	1.10	1.10					1.17	1.17	0.97	0.97			1.18	1.18	1.01	1.01			1.11	1.11					1.17	1.17	U
NPL			0.88	0.66	1.74	1.74					0.77	0.77	1.01	1.01	-1.41	-1.41			1.11	1.11			0.80	0.78					0.95	0.95	ΔT
			0.94	0.89	0.85	0.85					0.95	0.95	0.68	0.68	1.18	1.18			0.74	0.74			0.87	0.87					0.94	0.94	U
NRC			-0.45	-0.45	0.63	0.63					-0.34	-0.34	-0.10	-0.10	-2.52	-2.52	-1.11	-1.11					-0.33	-0.33					-0.16	-0.16	ΔT
			0.65	0.65	0.60	0.60					0.73	0.73	0.31	0.31	1.01	1.01	0.74	0.74					0.62	0.62					0.72	0.72	U
NRLM																															ΔT
																															U
PTB			-0.06	-0.12	0.96	0.96					-0.01	-0.01	0.23	0.23	-2.19	-2.19	-0.80	-0.78	0.33	0.33									0.17	0.17	ΔT
			0.79	0.79	0.75	0.75					0.86	0.86	0.55	0.55	1.11	1.11	0.87	0.87	0.62	0.62									0.85	0.85	U
SMU																															ΔT
																															U
VNIIM																															ΔT
																															U
VSL			-0.29	-0.29	0.79	0.79					-0.18	-0.18	0.06	0.06	-2.36	-2.36	-0.95	-0.95	0.16	0.16			-0.17	-0.17							ΔT
			0.87	0.87	0.84	0.84					0.93	0.93	0.66	0.66	1.17	1.17	0.94	0.94	0.72	0.72			0.85	0.85							U

Table 29a. Direct and bilateral comparison results for the gallium melting point.

	Direct Comparison (Lab X - NIST)			Bilateral Differences (Lab X - NIST)		
	ΔT, mK	u_c (k=1), mK	U (95%), mK	ΔT, mK	u_c (k=1), mK	U (95%), mK
IMGC	0.00	0.04	0.12	0.09	0.06	0.13
NPL	-0.04	0.12	0.24	-0.17	0.21	0.42
NRC	-0.17	0.11	0.25	-0.14	0.13	0.27
VNIIM	0.09	0.02	0.04	0.01	0.08	0.19
VSL	0.25	0.06	0.12	-0.23	0.21	0.41

Table 29b. Indirect and bilateral comparison results for the gallium melting point.

	Indirect Comparison (Lab X - NIST)			Bilateral Differences (Lab X - NIST)		
	ΔT, mK	u_c (k=1), mK	U (95%), mK	ΔT, mK	u_c (k=1), mK	U (95%), mK
BIPM	-0.03	0.08	0.16	-0.09	0.08	0.16
BNM	0.00	0.14	0.28	-0.03	0.15	0.29
KRISS	-0.27	0.29	0.64	0.00	0.20	0.46
MSL	0.15	0.16	0.32	0.17	0.18	0.36
NIM	0.96	0.23	0.48	-0.59	0.28	0.57
NML	0.09	0.08	0.16	-0.16	0.13	0.26
NRLM	1.16	0.11	0.21	-0.37	0.11	0.22
PTB	0.07	0.11	0.21	0.20	0.12	0.24
SMU	0.06	0.10	0.19	0.04	0.10	0.19

Table 30a. Direct and bilateral comparison results for the cadmium freezing point.

	Direct Comparison (Lab X - NIST)			**Bilateral Differences (Lab X - NIST)**		
	ΔT, mK	u_c (k=1), mK	U (95%), mK	ΔT, mK	u_c (k=1), mK	U (95%), mK
IMGC	-0.01	0.07	0.16	-1.47	0.33	0.66
NRC	-0.11	0.15	0.34	-0.95	0.21	0.42
VNIIM	0.01	0.31	1.30	0.40	0.54	1.46
VSL	-0.89	0.06	0.12	-1.14	NA	NA

Table 30b. Indirect and bilateral comparison results for the cadmium freezing point.

	Indirect Comparison (Lab X - NIST)			**Bilateral Differences (Lab X - NIST)**		
	ΔT, mK	u_c (k=1), mK	U (95%), mK	ΔT, mK	u_c (k=1), mK	U (95%), mK
NIM	0.12	1.10	2.70	1.28	0.87	1.96
NML	-0.37	0.18	0.36	-1.21	0.20	0.41

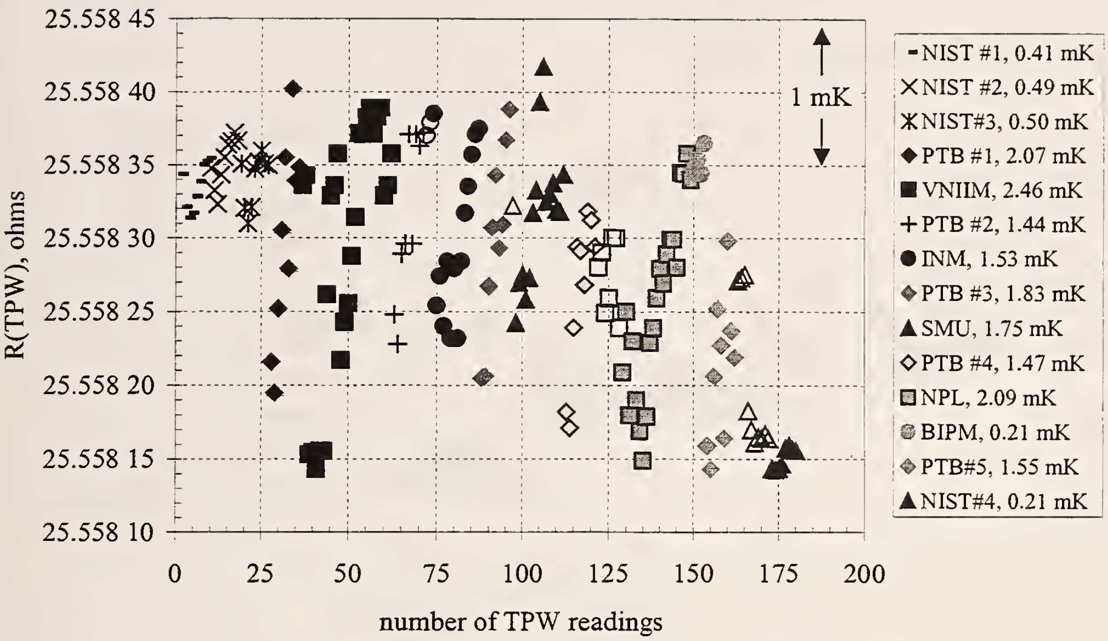


Figure 1. The resistance of SPRT 4385 (Rosemount 162CE) at the triple point of water as obtained by the participants during the course of the comparison.

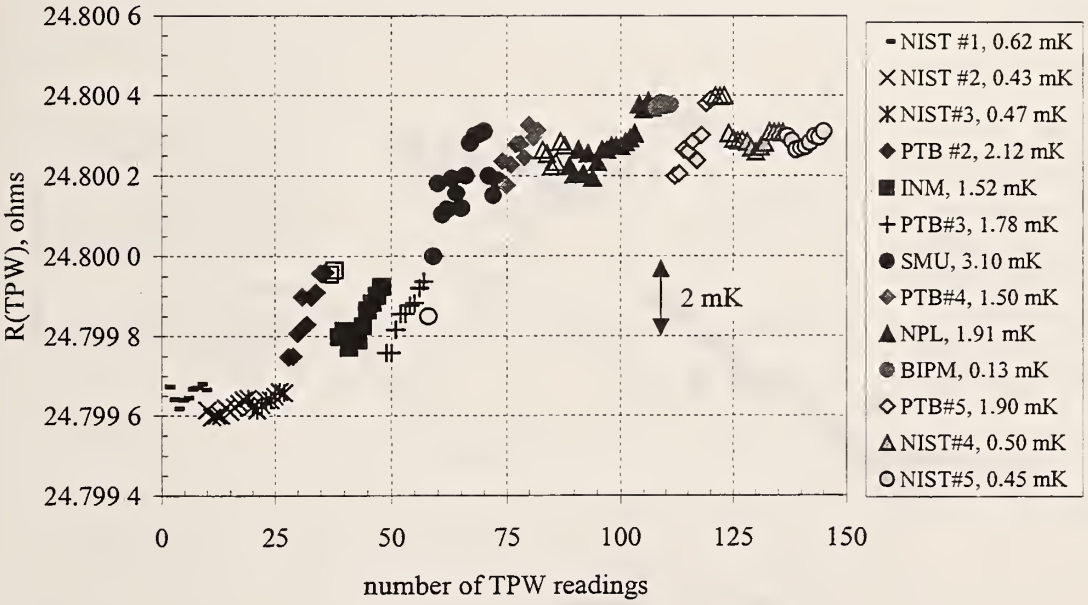


Figure 2. The resistance of SPRT 1030 (Hart Model 5681) at the triple point of water as obtained by the participants during the course of the comparison.

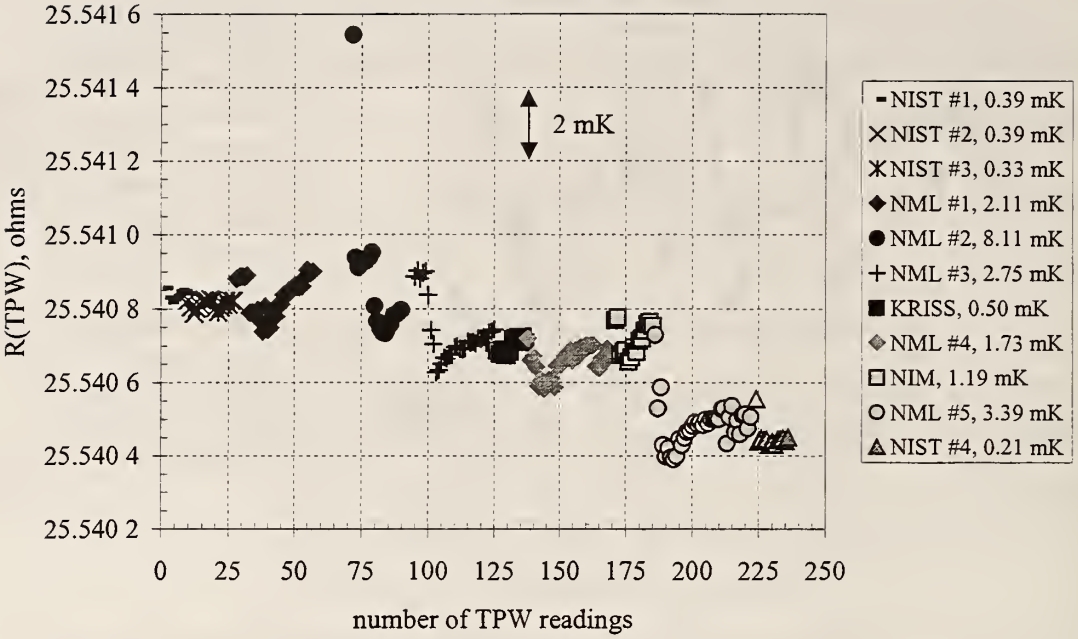


Figure 3. The resistance of SPRT 4386 (Rosemount 162CE) at the triple point of water as obtained by the participants during the course of the comparison.

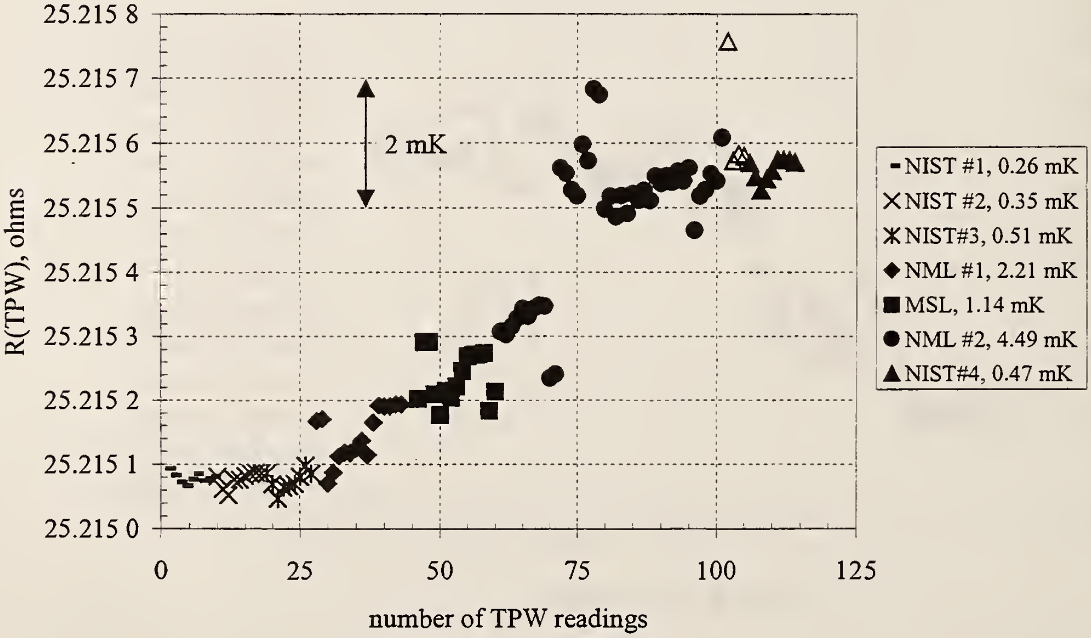


Figure 4. The resistance of SPRT 1032 (Hart Model 5681) at the triple point of water as obtained by the participants during the course of the comparison.

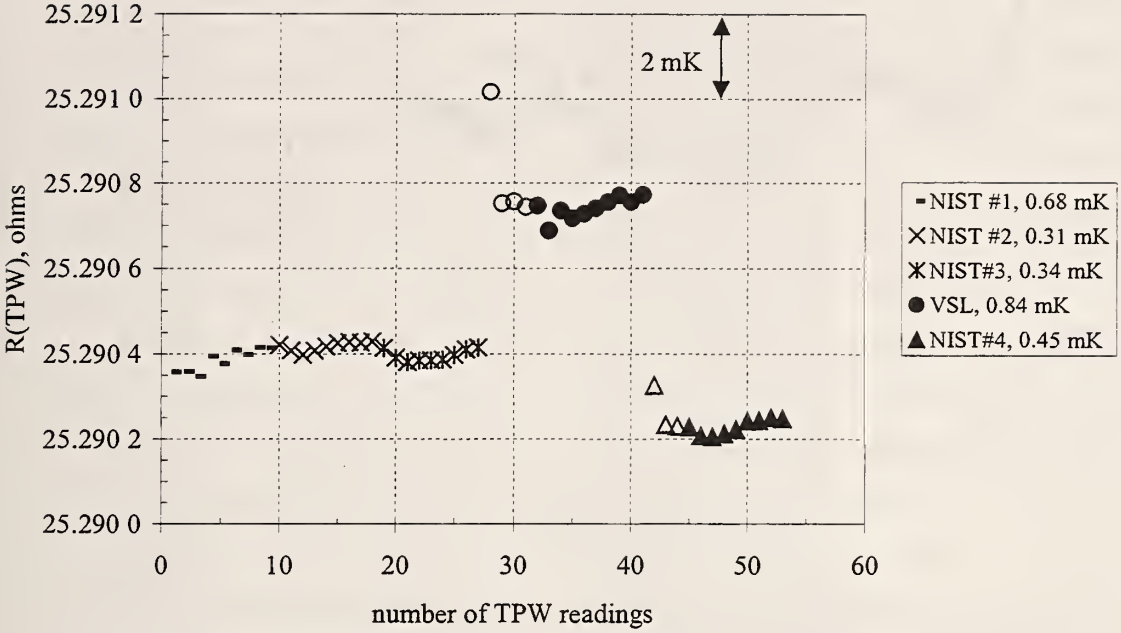


Figure 5. The resistance of SPRT 1094 (Hart Model 5681) at the triple point of water as obtained by the participants during the course of the comparison.

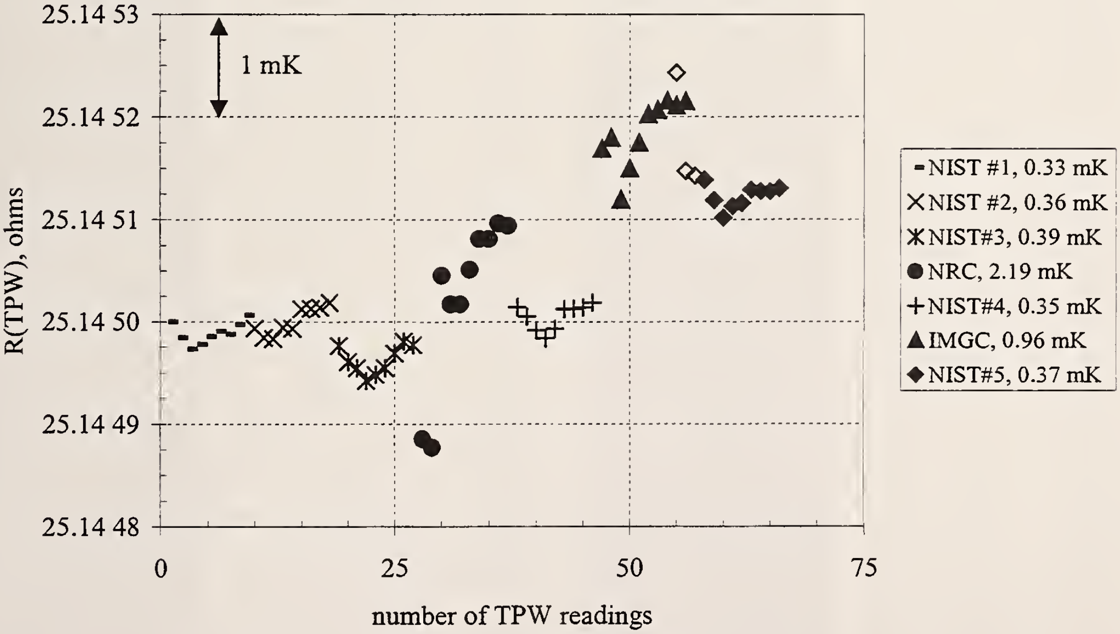


Figure 6. The resistance of SPRT 1098 (Hart Model 5681) at the triple point of water as obtained by the participants during the course of the comparison.

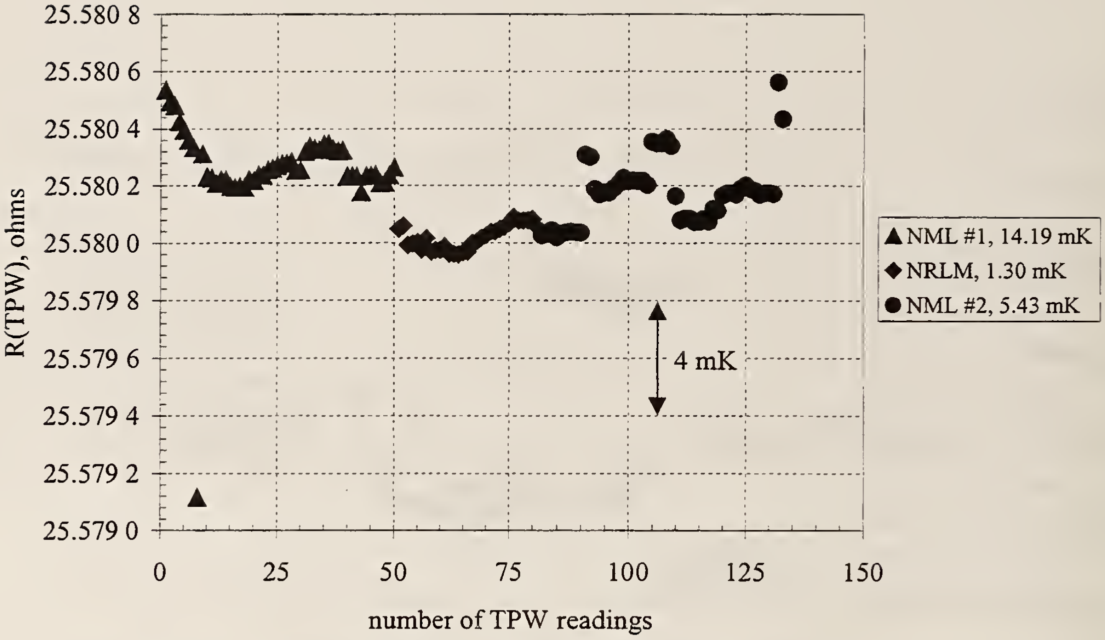


Figure 7. The resistance of SPRT 040 (Isotech Model 0670) at the triple point of water as obtained by NML and NRLM during the course of the comparison.

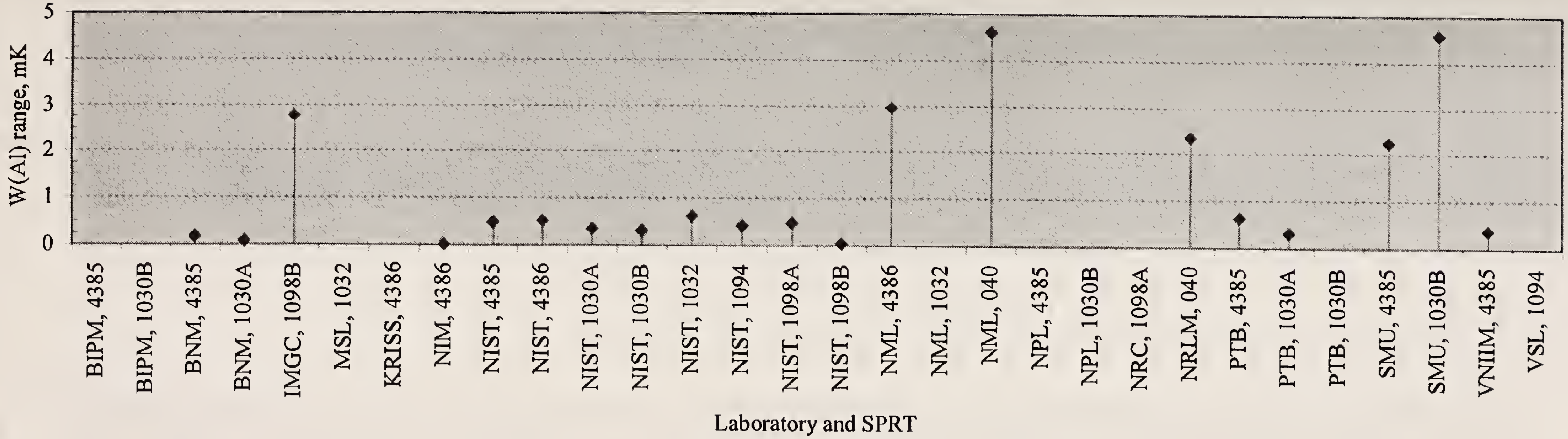


Figure 8. Range of *W*(Al) values, expressed in mK equivalence, by laboratory and SPRT.

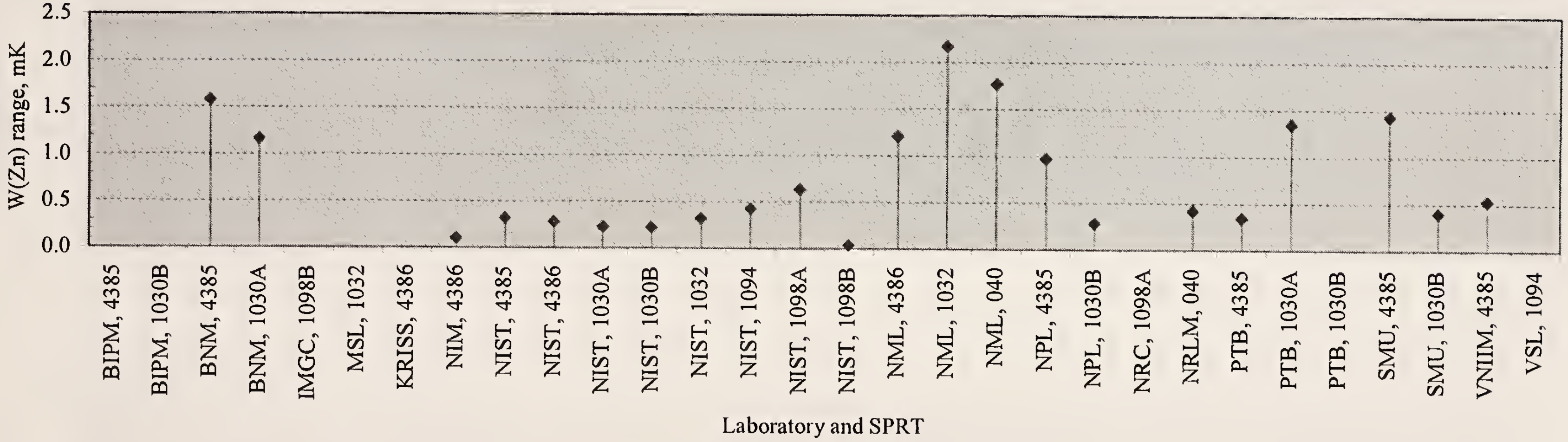


Figure 9. Range of *W*(Zn) values, expressed in mK equivalence, by laboratory and SPRT.

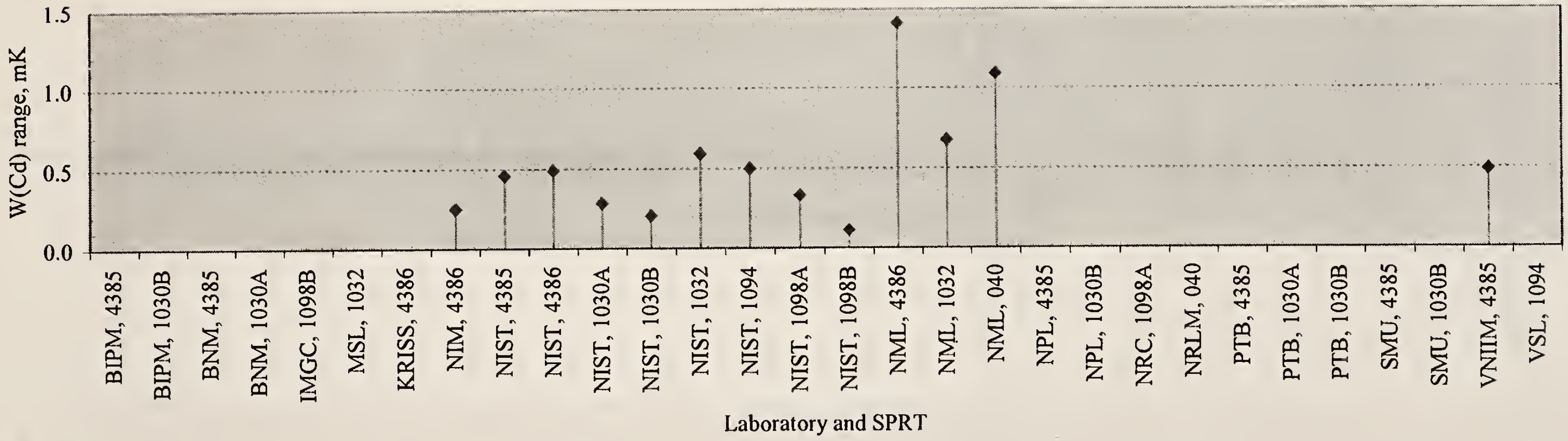


Figure 10. Range of *W*(Cd) values, expressed in mK equivalence, by laboratory and SPRT.

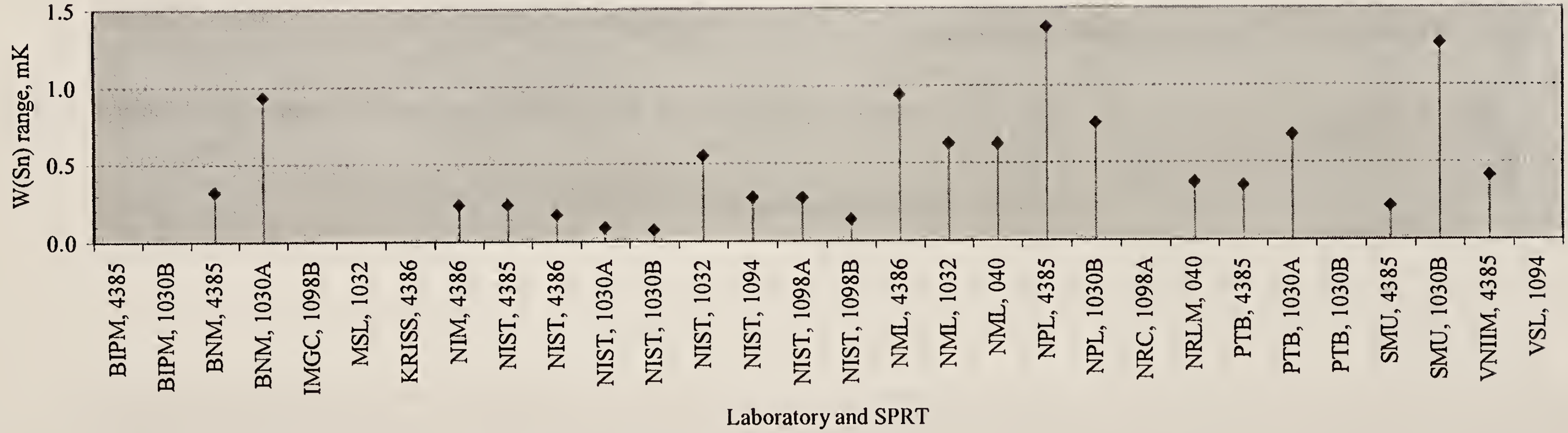


Figure 11. Range of *W*(Sn) values, expressed in mK equivalence, by laboratory and SPRT.

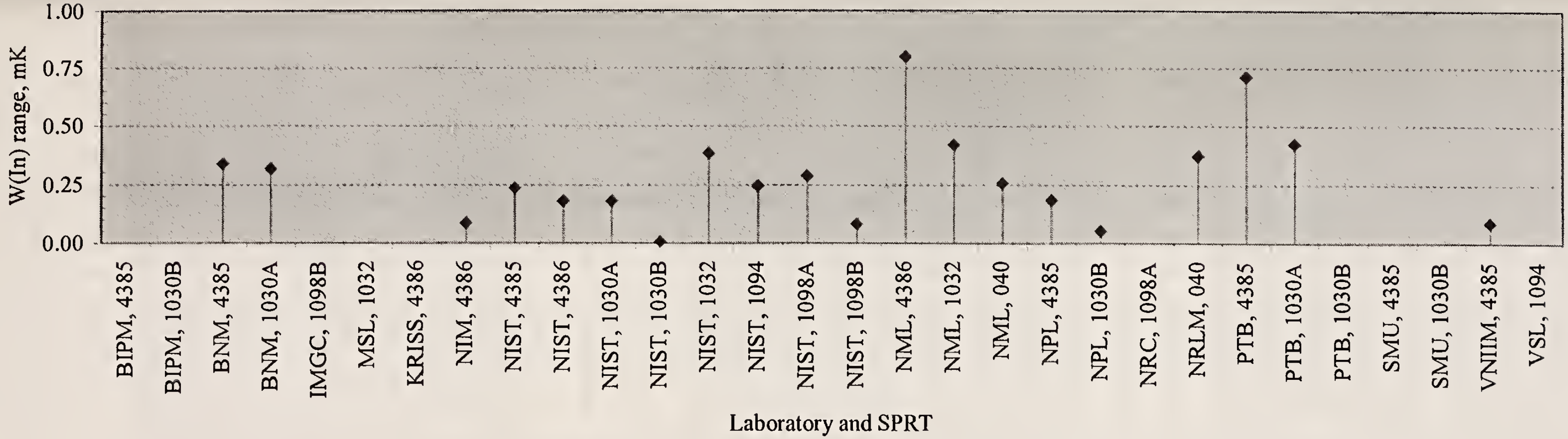


Figure 12. Range of *W*(In) values, expressed in mK equivalence, by laboratory and SPRT.

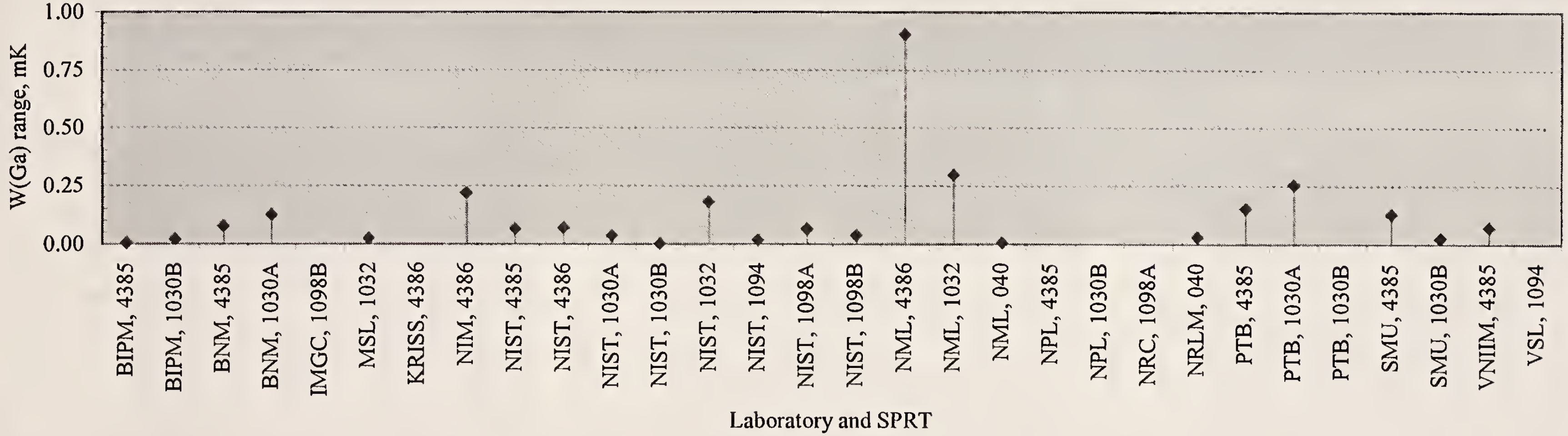


Figure 13. Range of *W*(Ga) values, expressed in mK equivalence, by laboratory and SPRT.

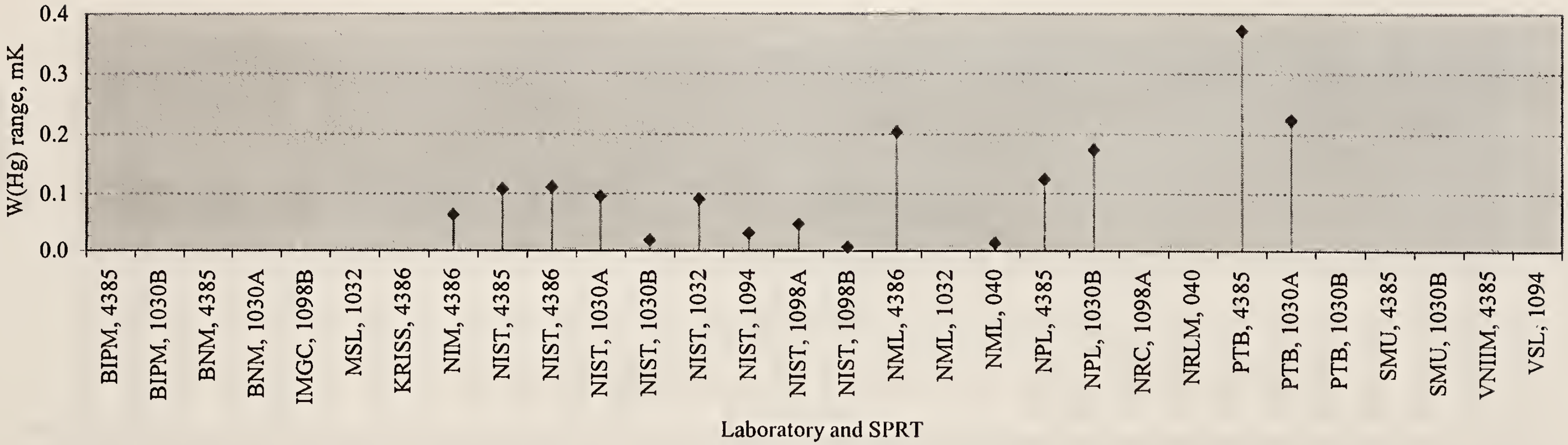


Figure 14. Range of *W*(Hg) values, expressed in mK equivalence, by laboratory and SPRT.

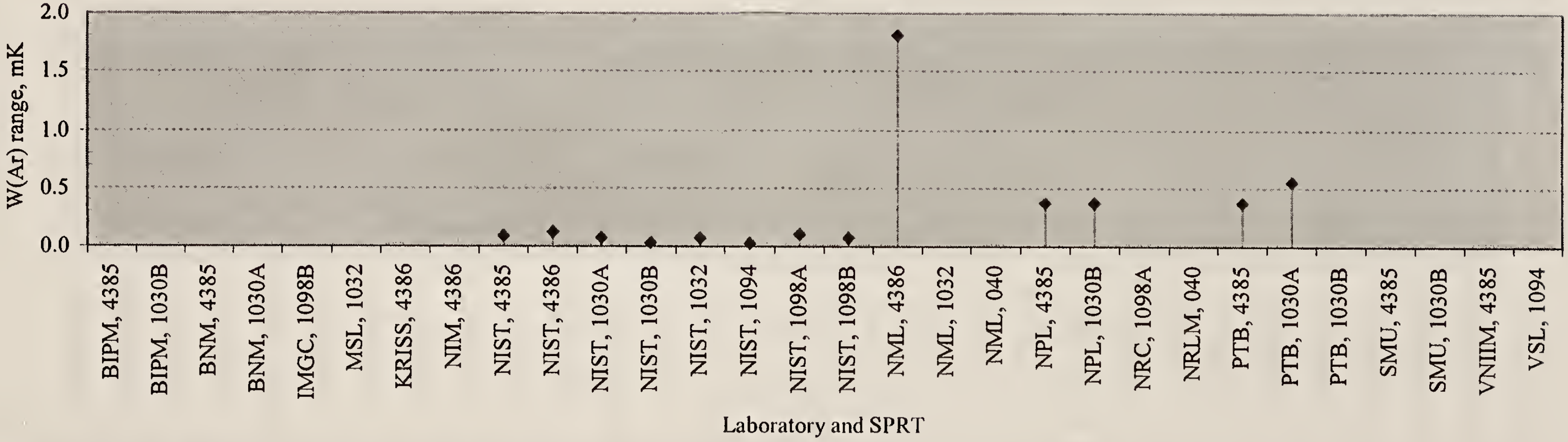


Figure 15. Range of *W*(Ar) values, expressed in mK equivalence, by laboratory and SPRT.

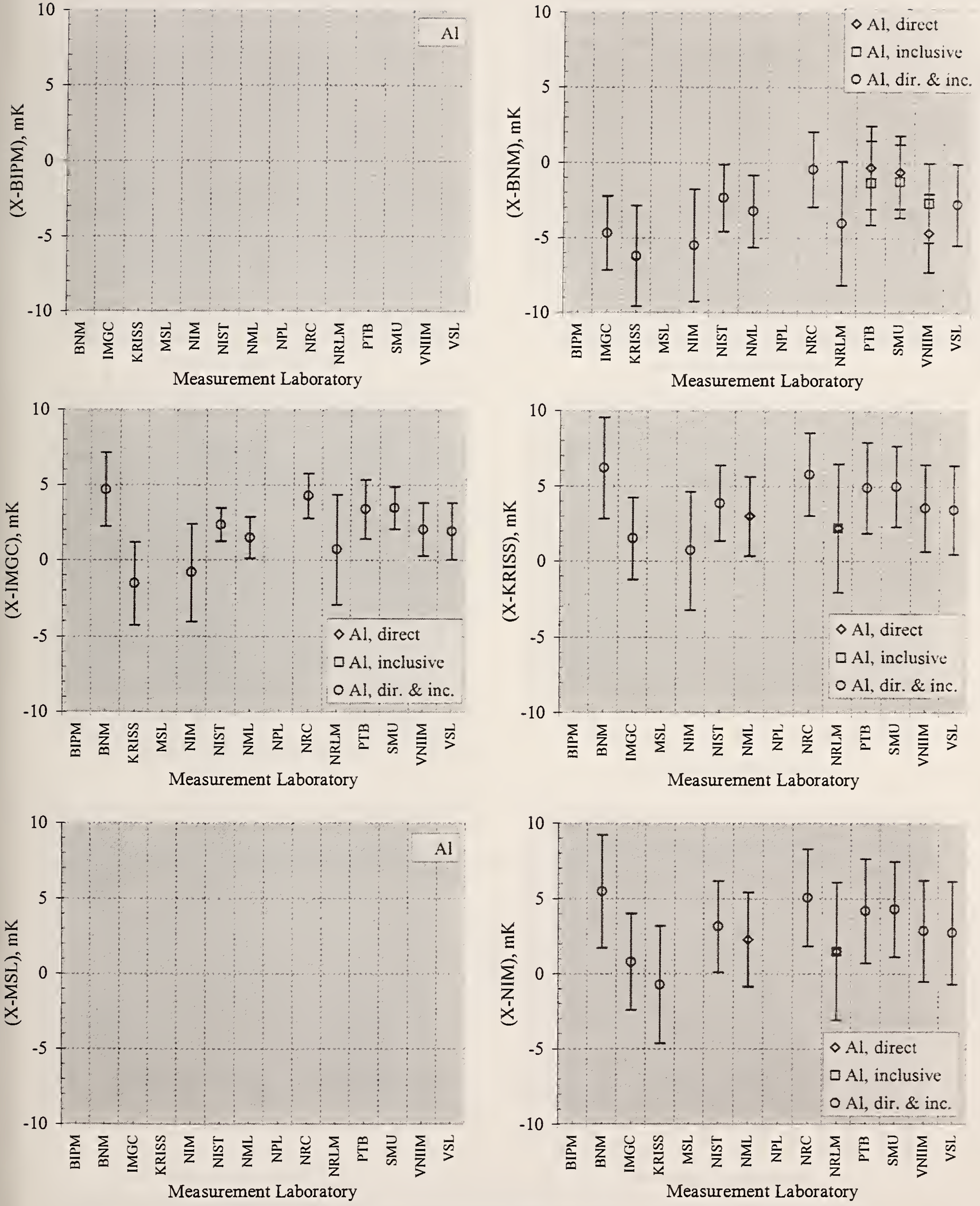


Figure 16. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Al freezing point.

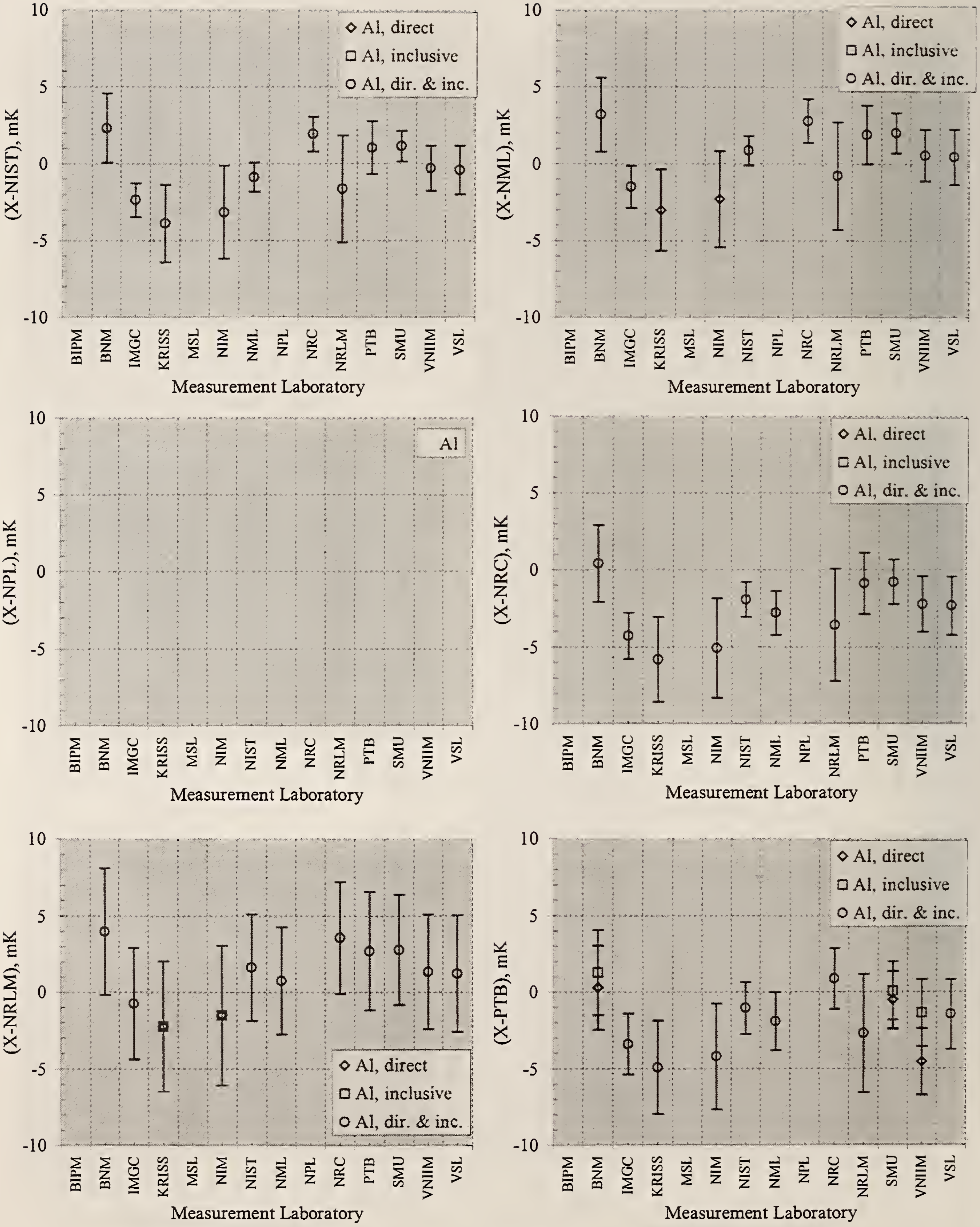


Figure 16. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Al freezing point. (continued)

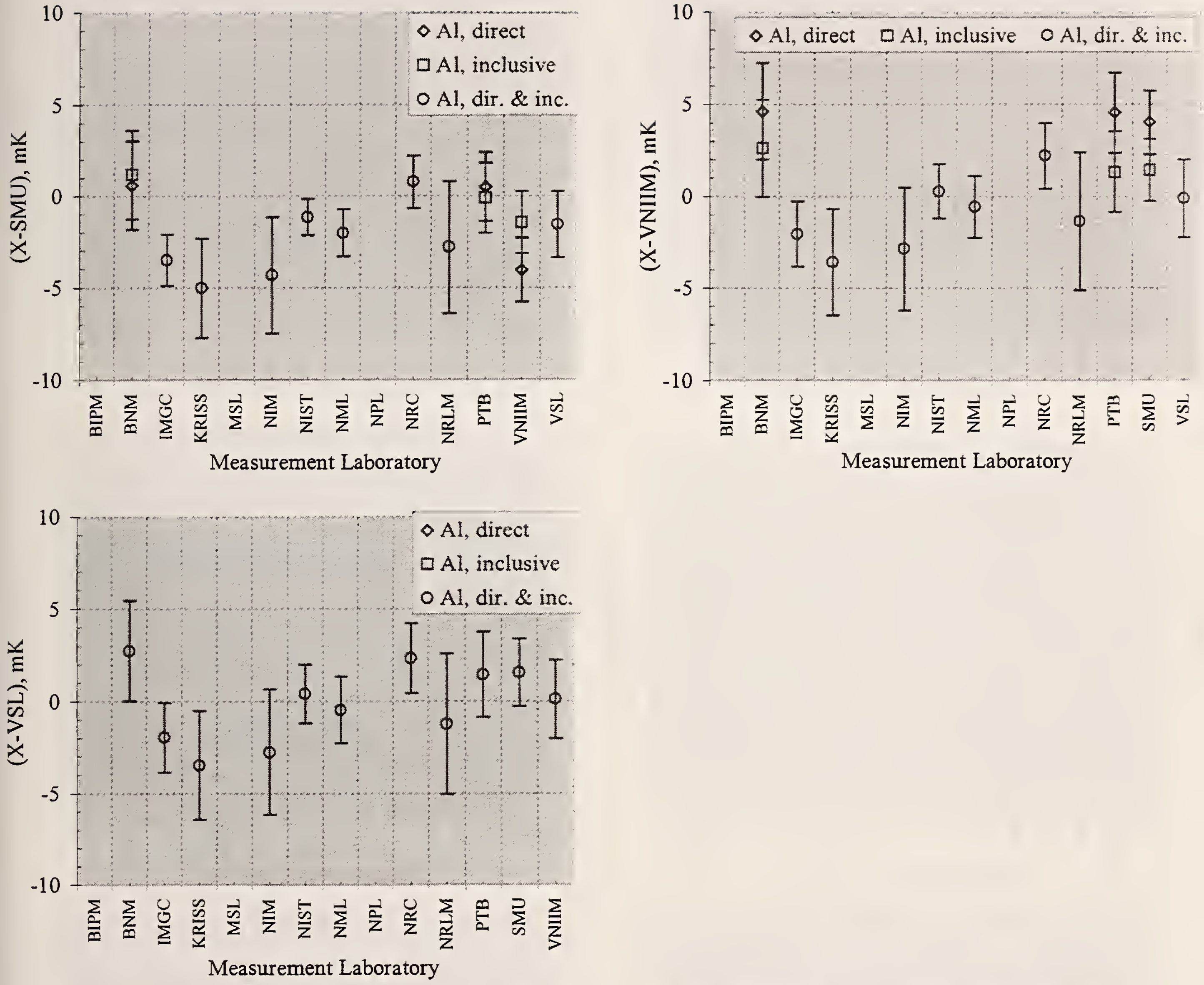


Figure 16. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Al freezing point. (continued)

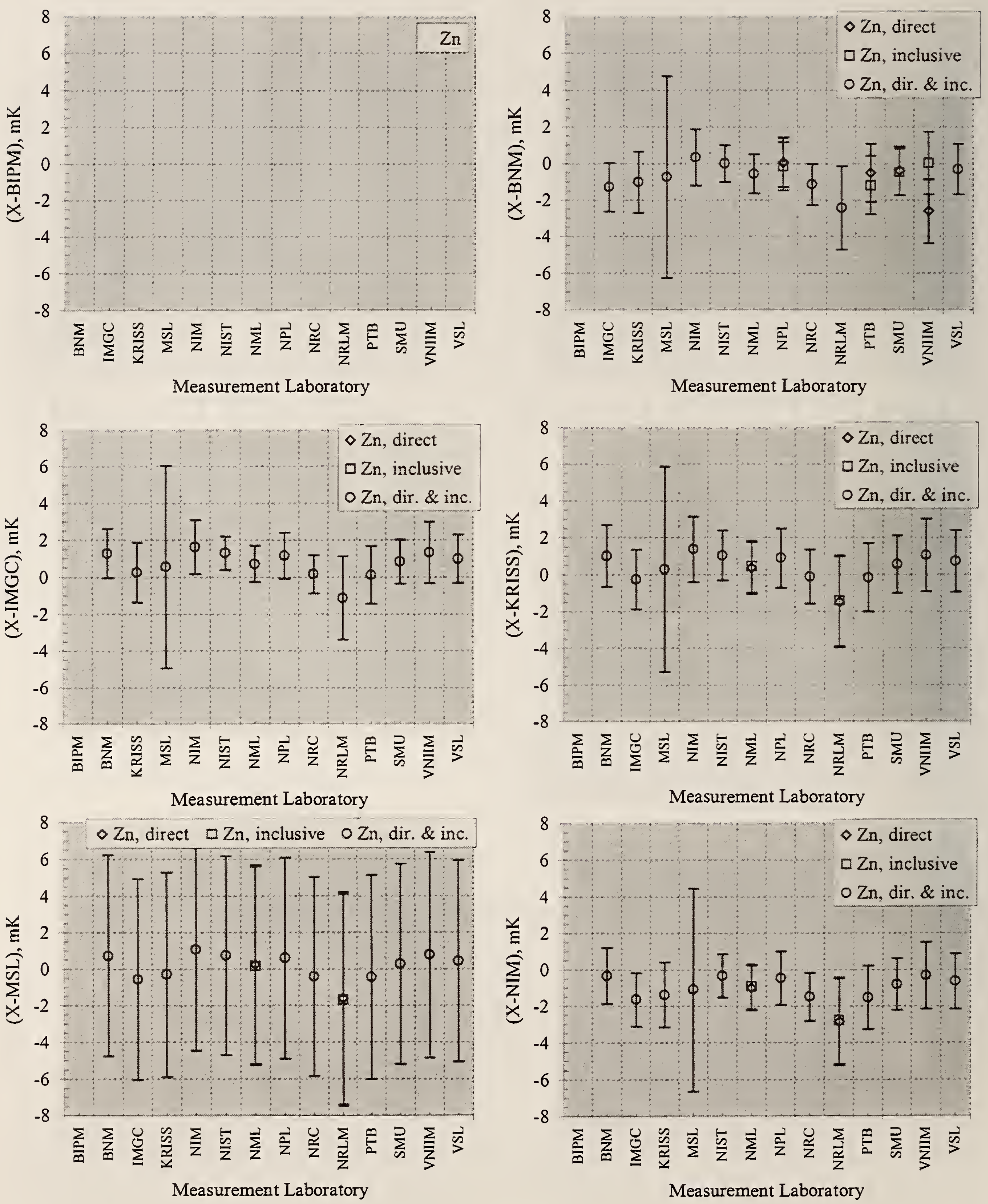


Figure 17. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Zn freezing point.

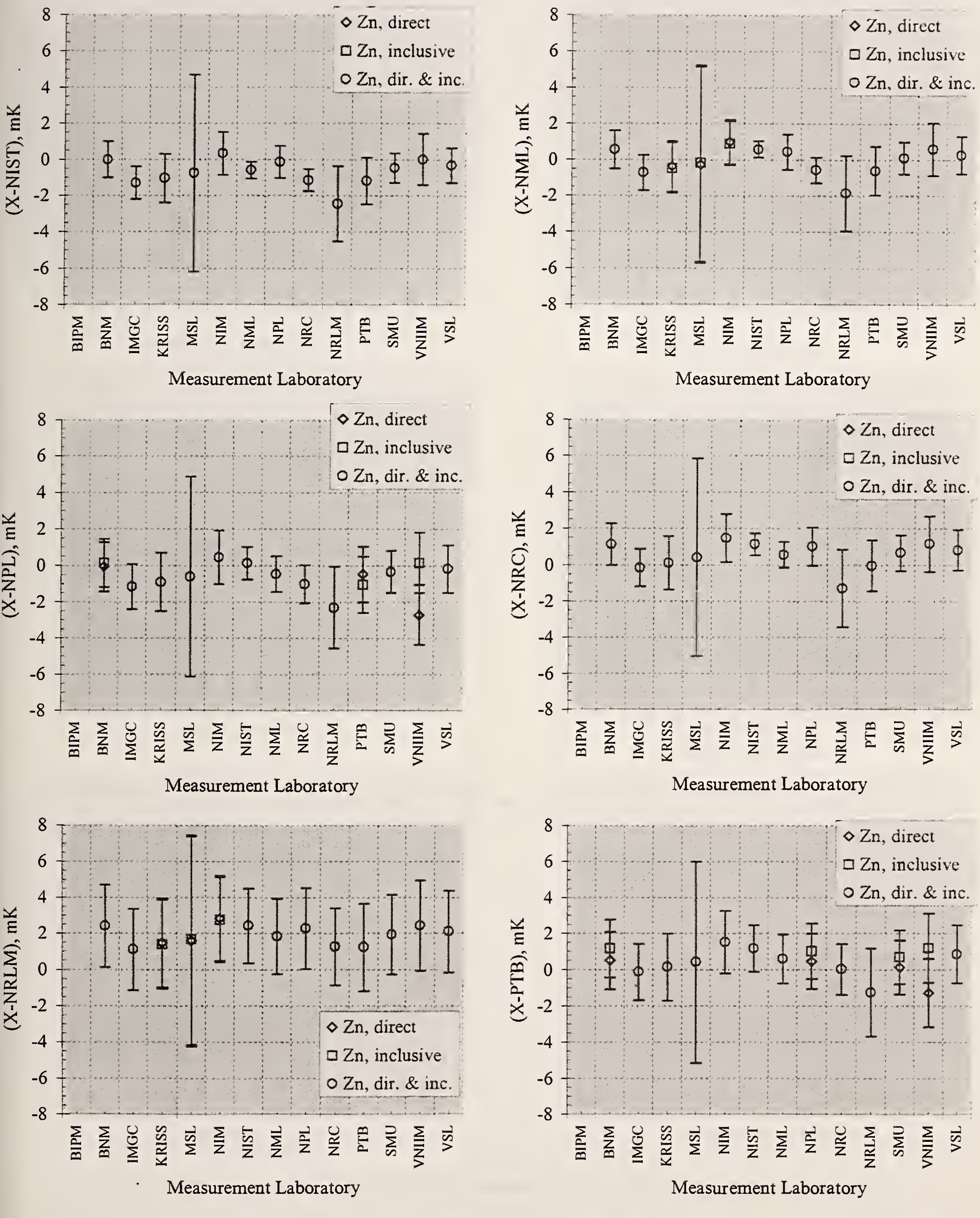


Figure 17. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the Zn freezing point. (continued)

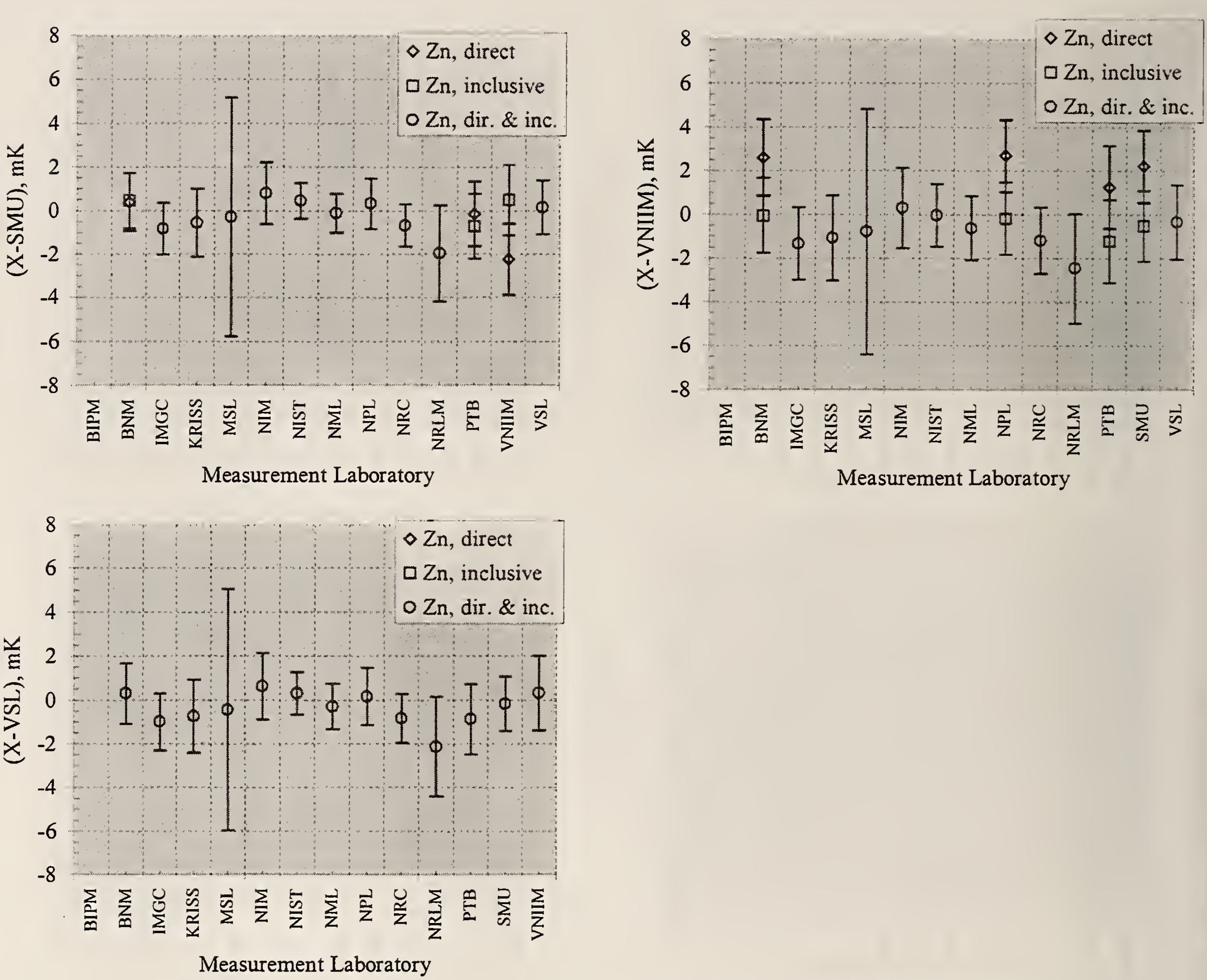


Figure 17. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Zn freezing point. (continued)

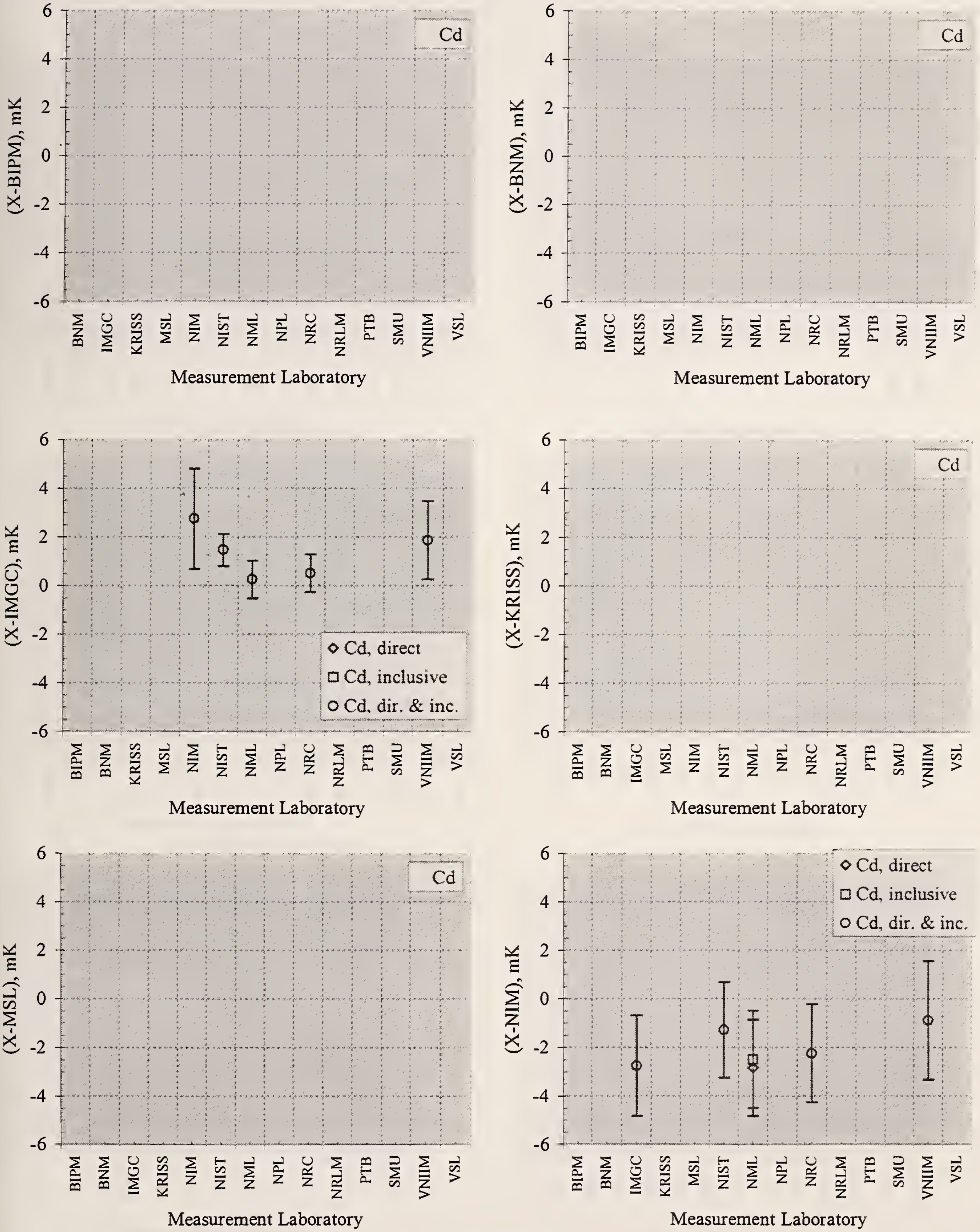


Figure 18. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the Cd freezing point.

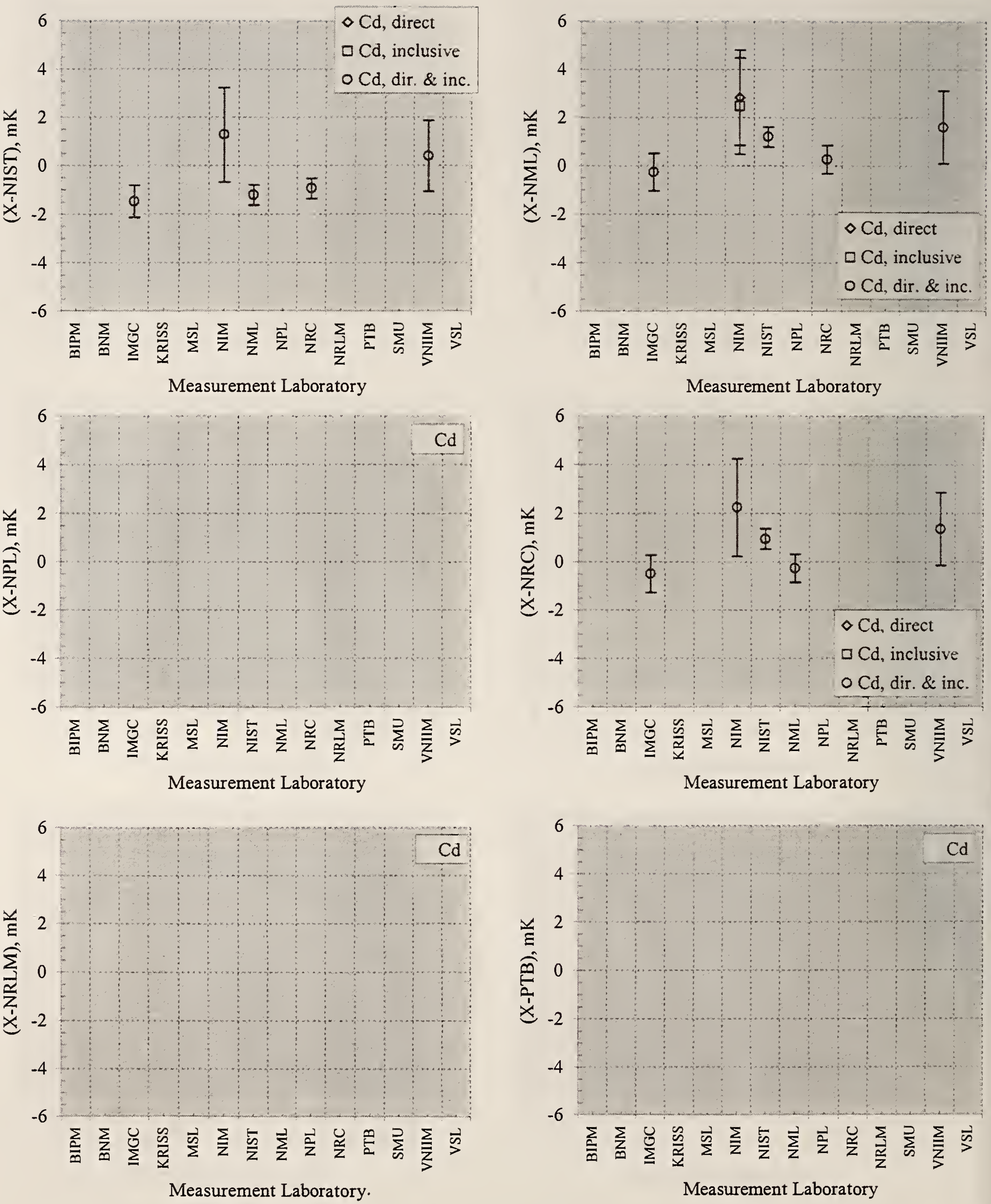


Figure 18. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the Cd freezing point. (continued)

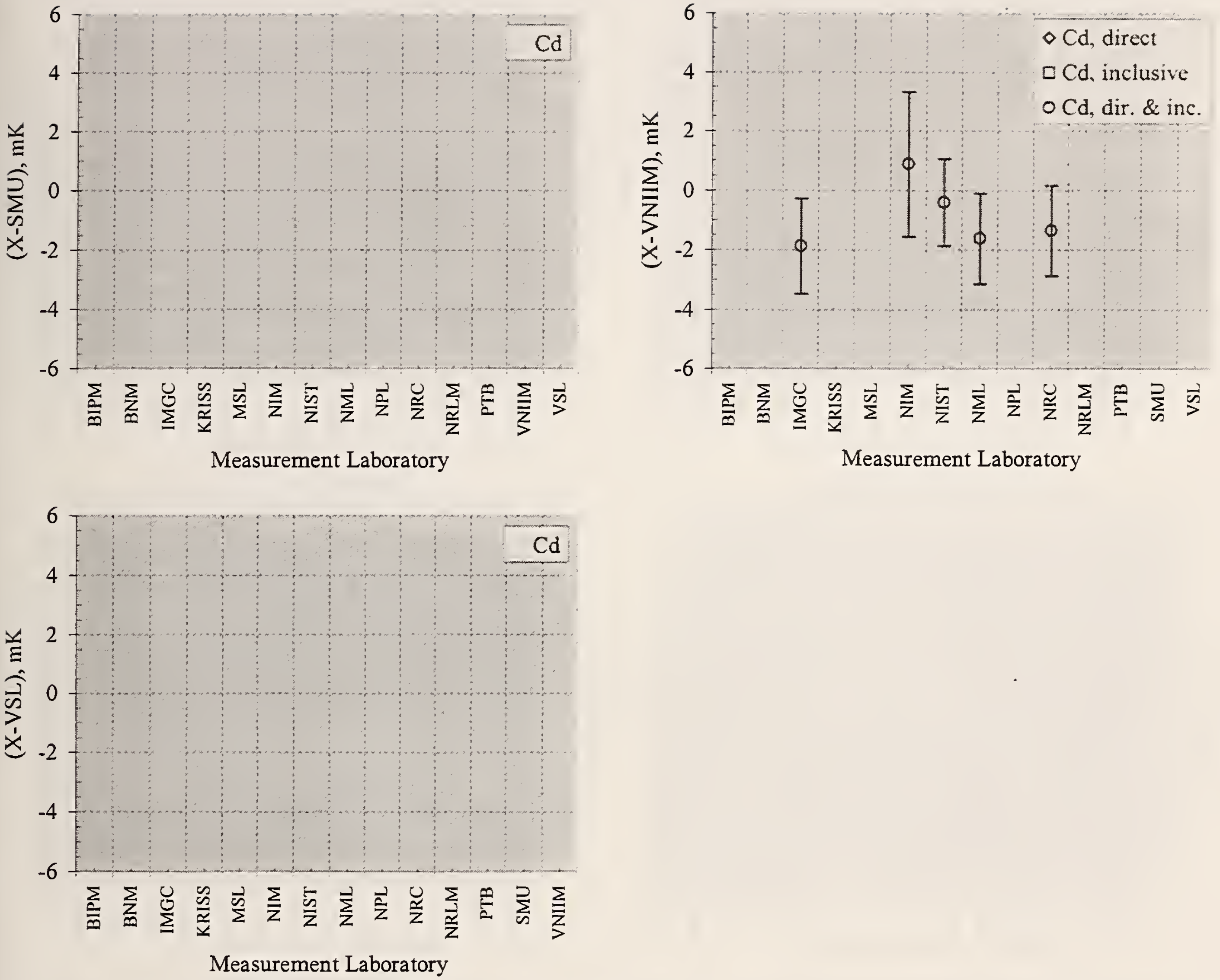


Figure 18. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the Cd freezing point. (continued)

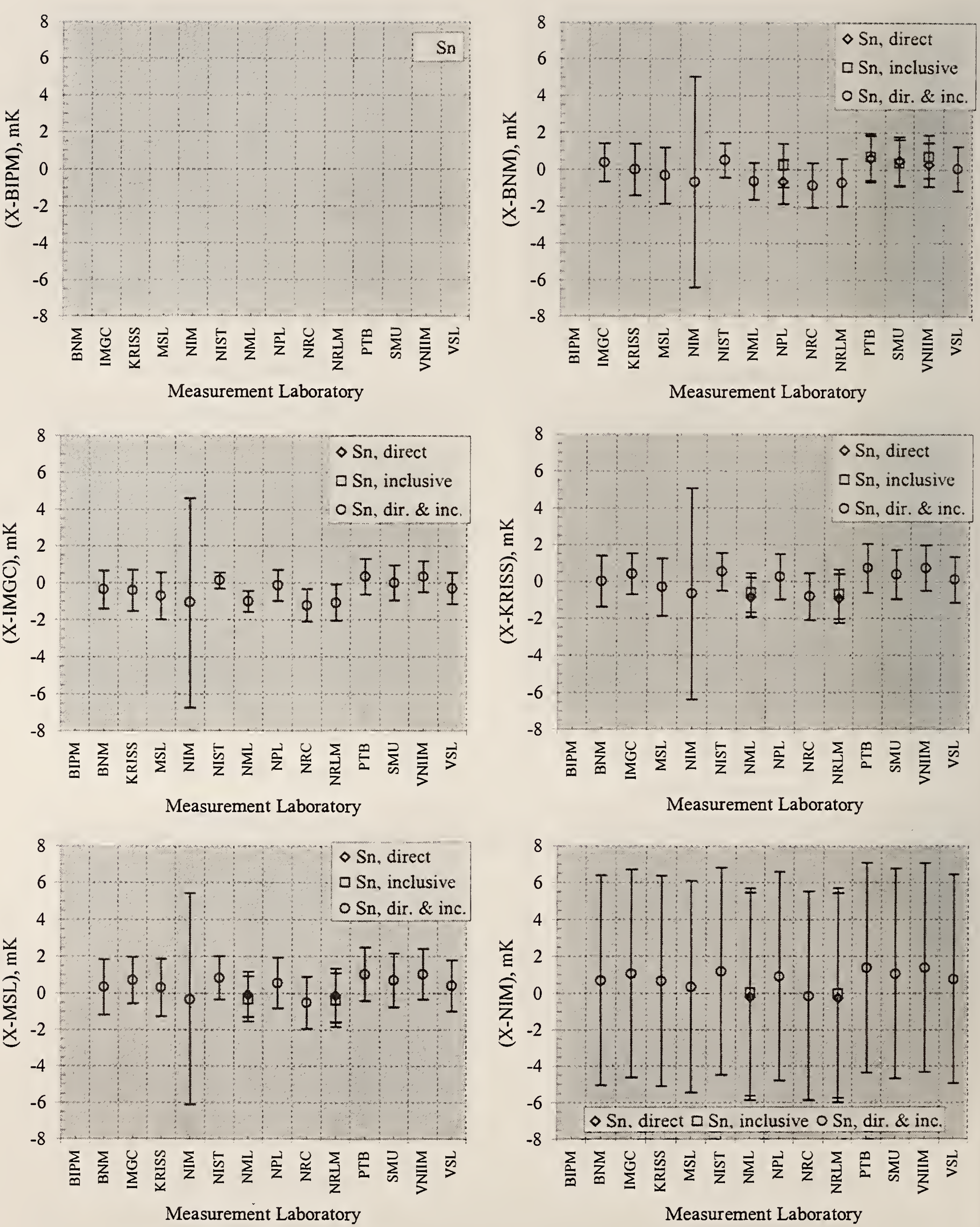


Figure 19. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Sn freezing point.

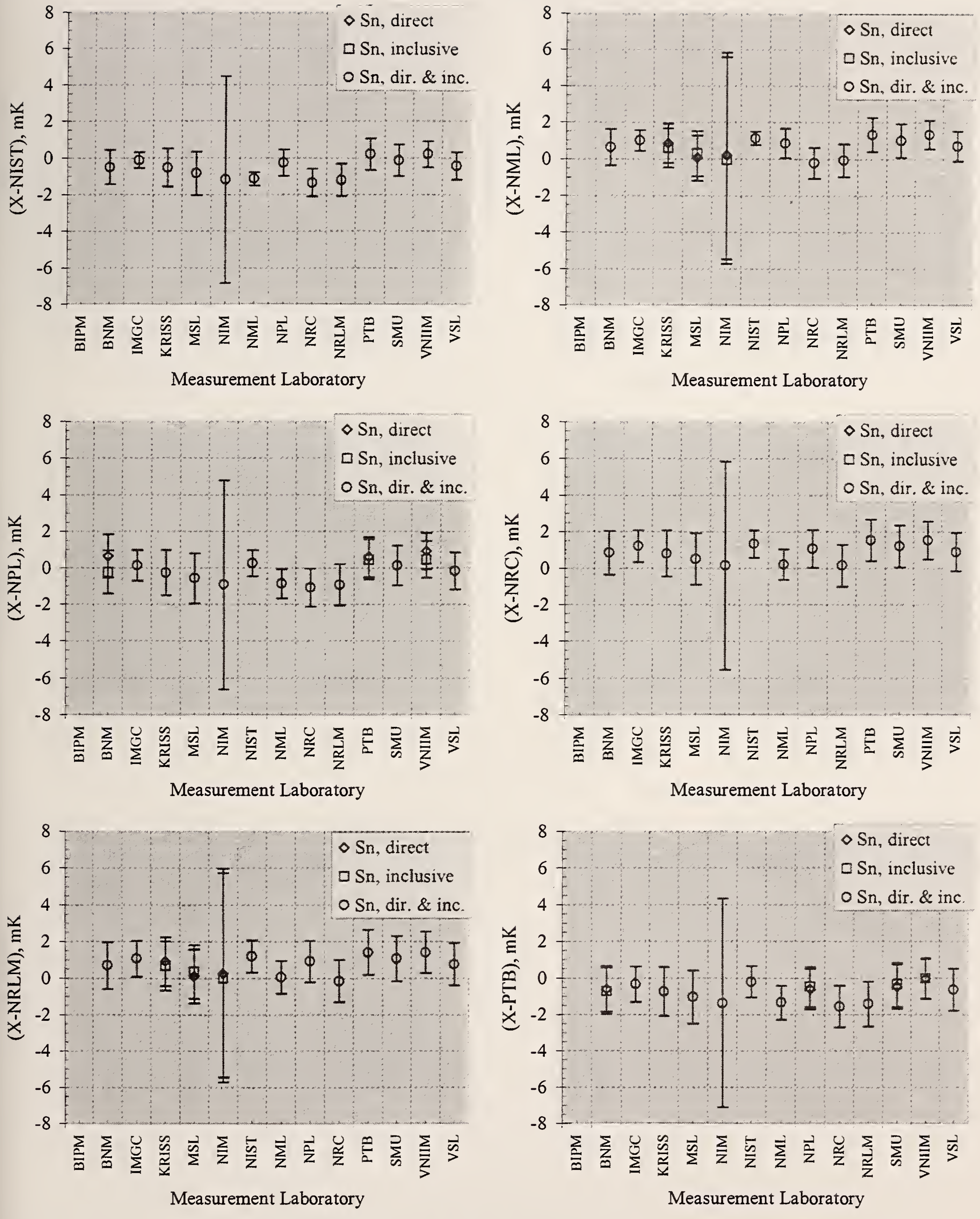


Figure 19. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Sn freezing point. (continued)

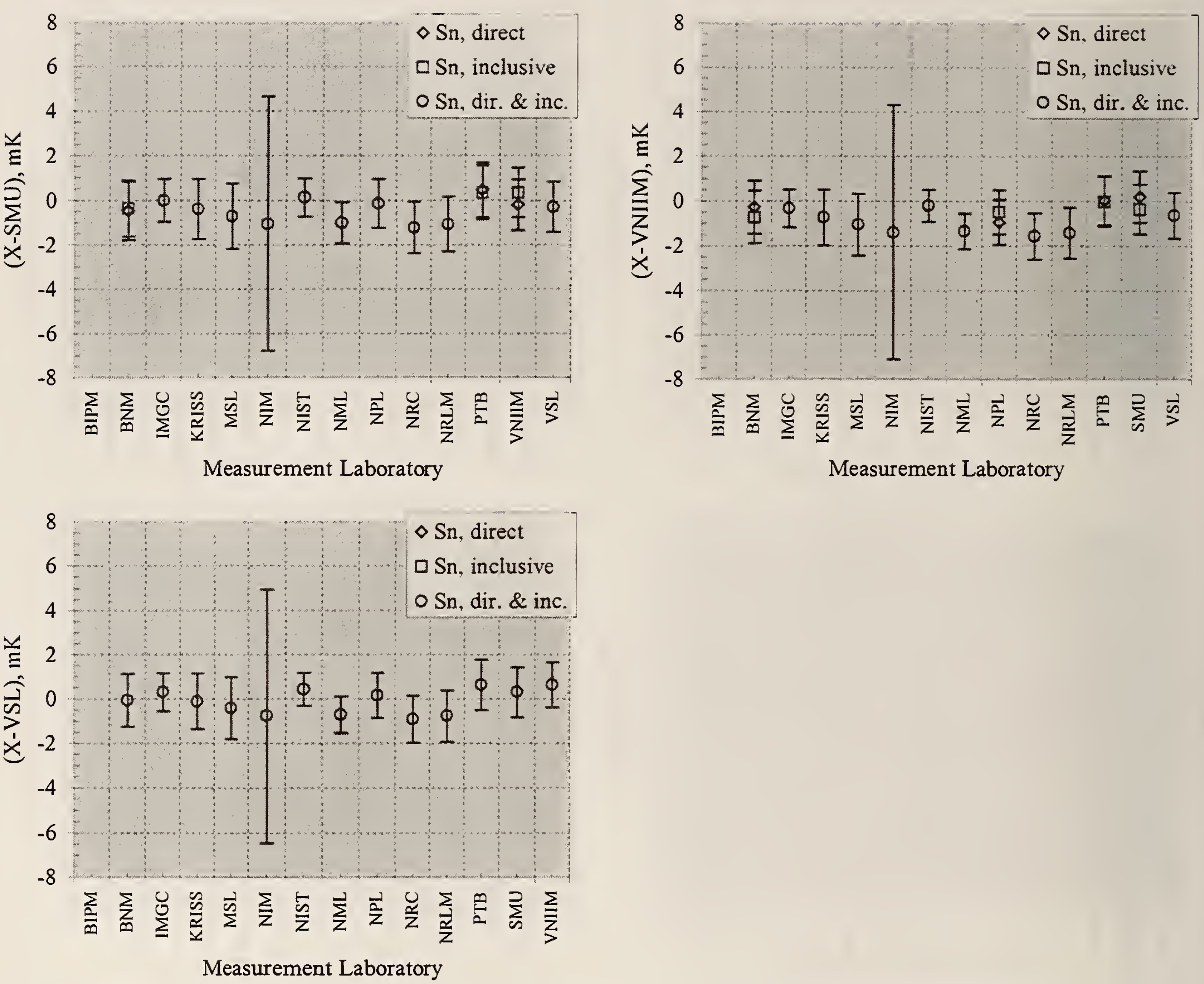


Figure 19. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the Sn freezing point. (continued)

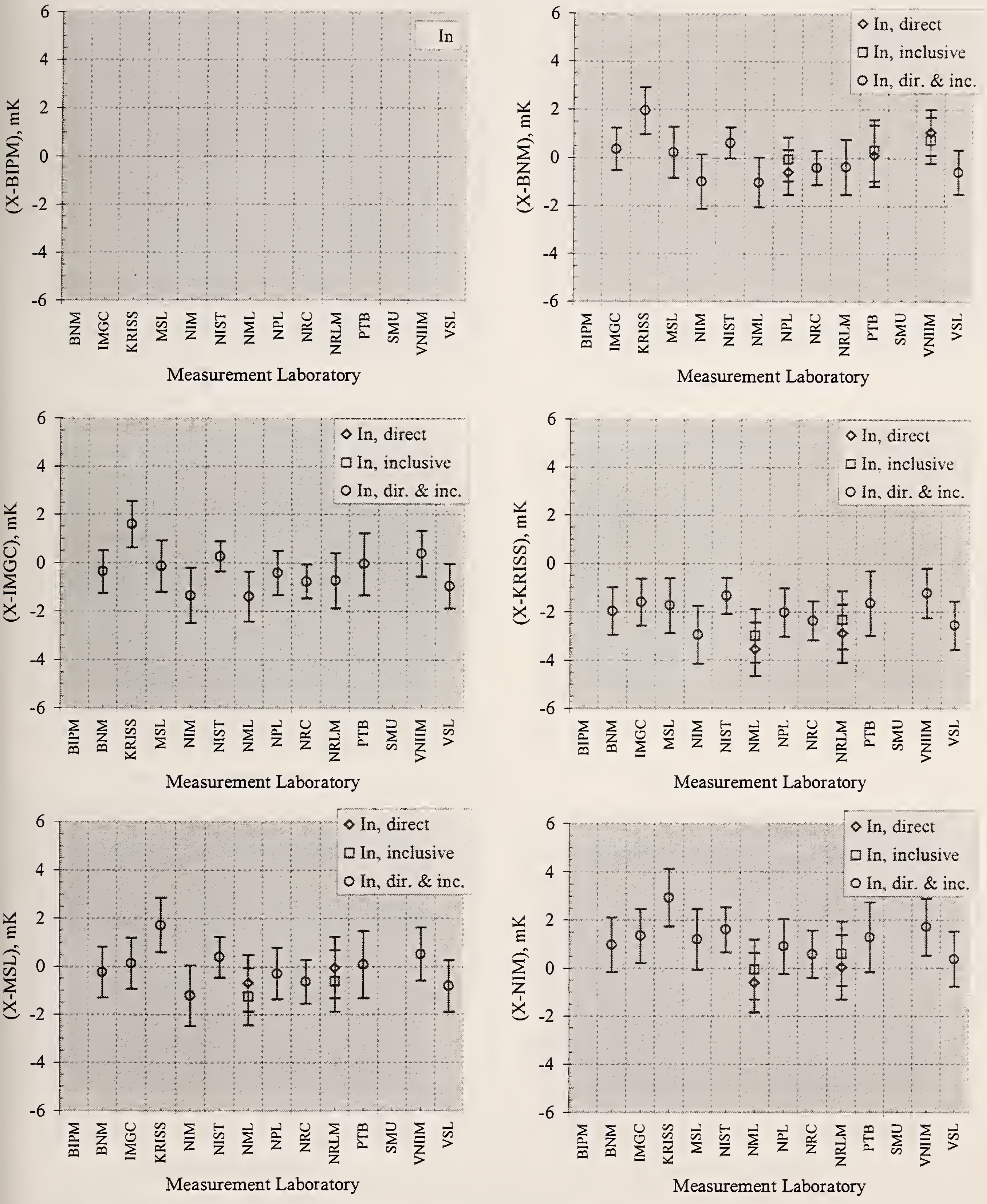


Figure 20. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the In freezing point.

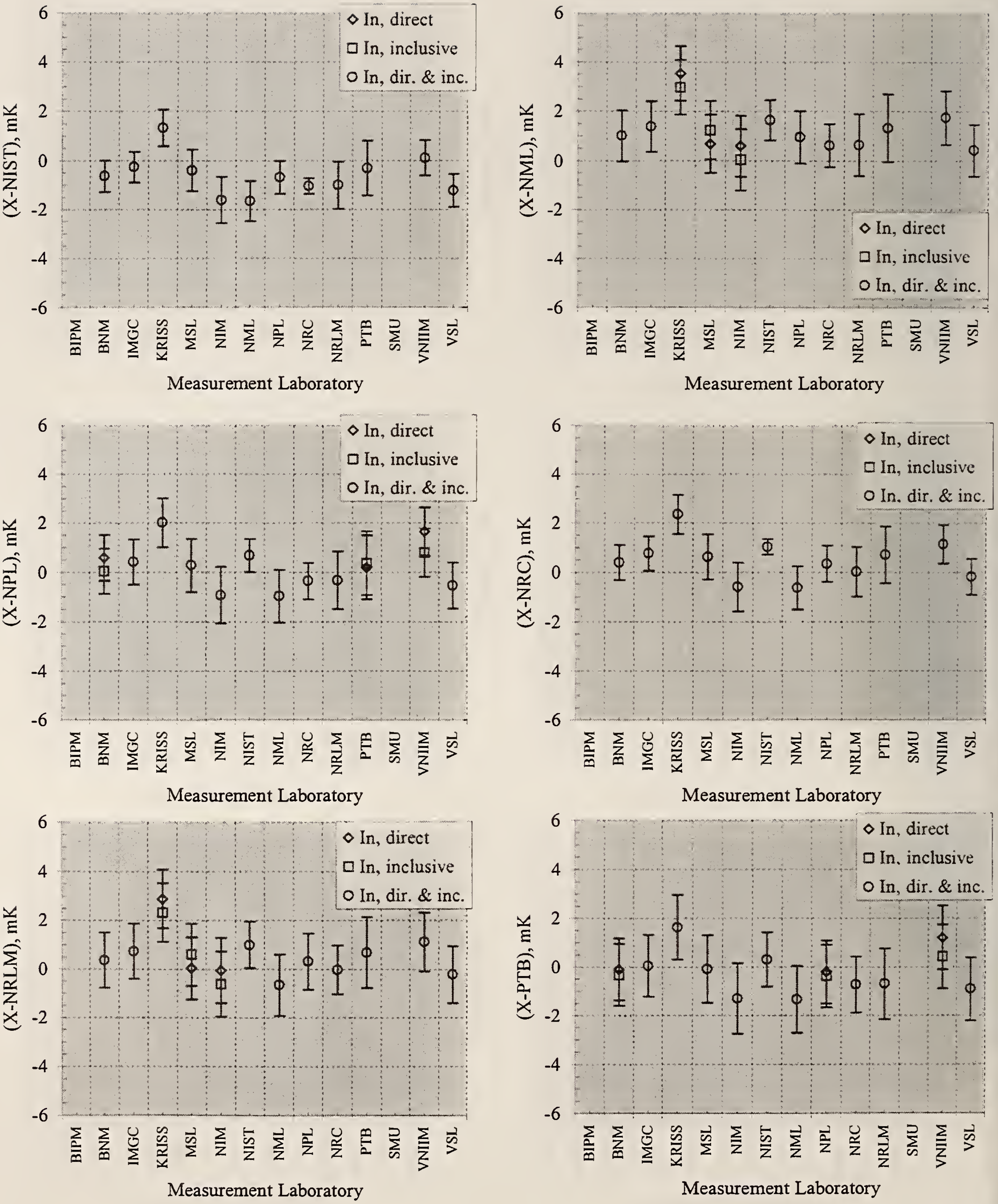


Figure 20. Differences, with U (95 %), in ITS-90 realizations between laboratories at the In freezing point. (continued)

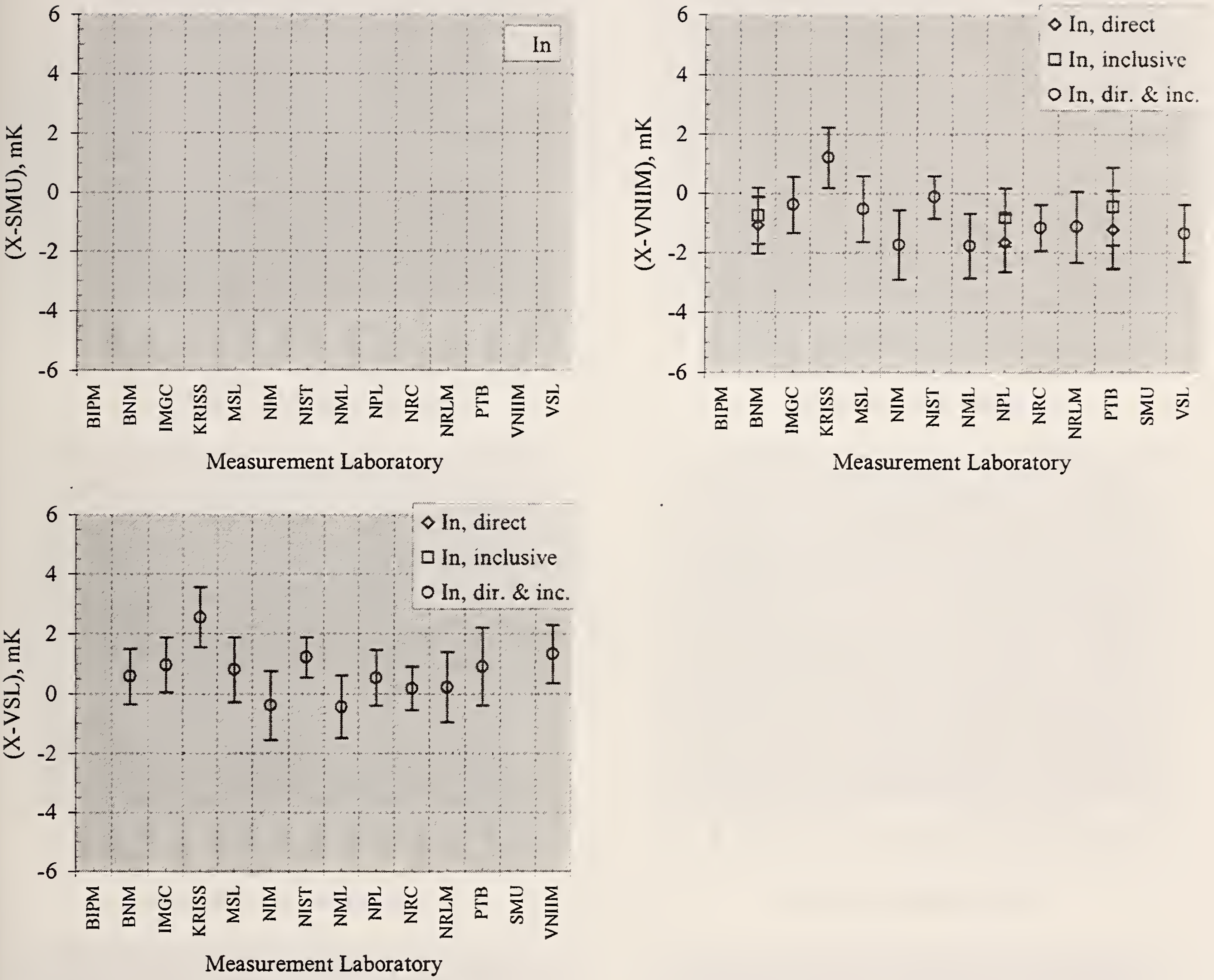


Figure 20. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the In freezing point. (continued)

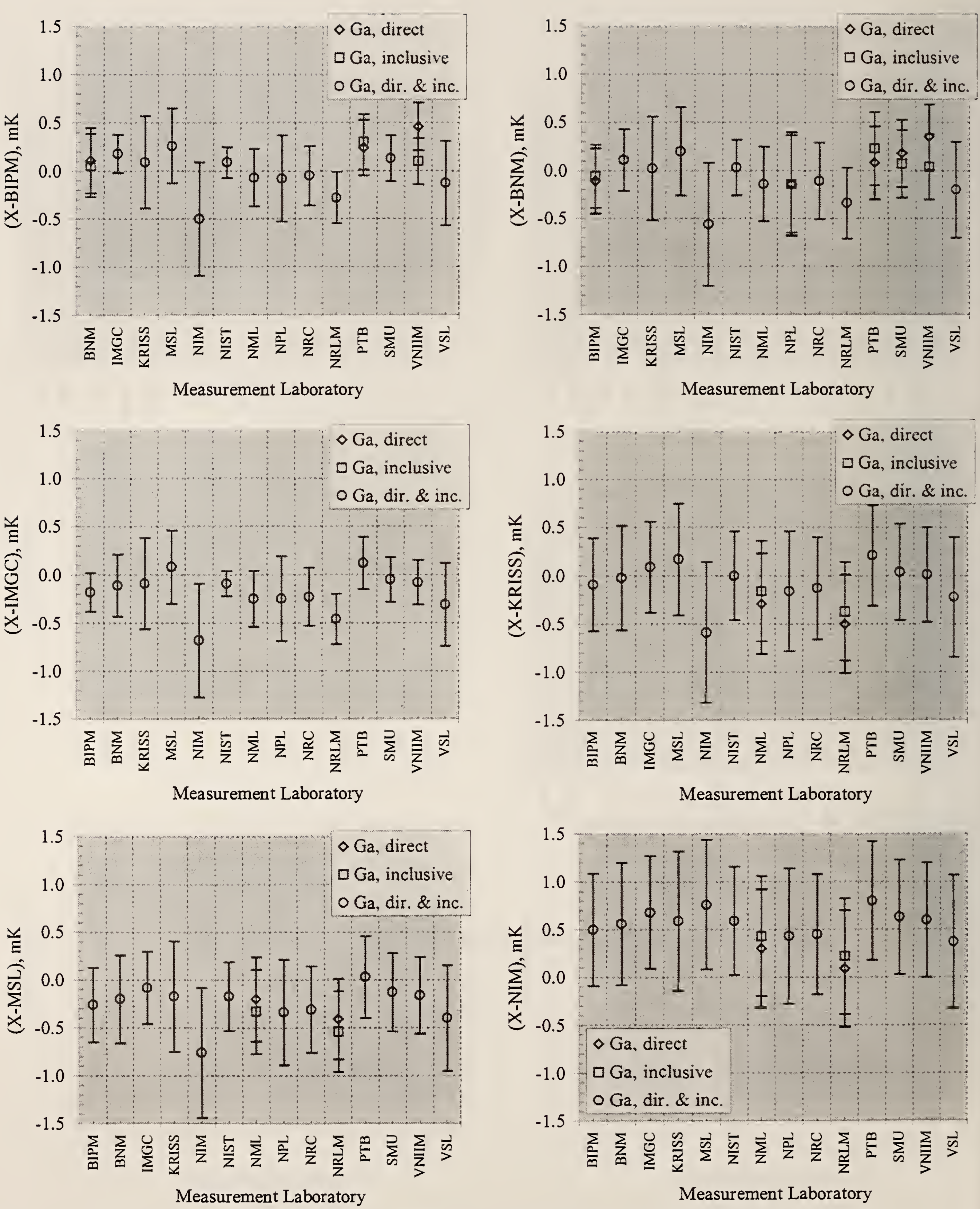


Figure 21. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Ga melting point.

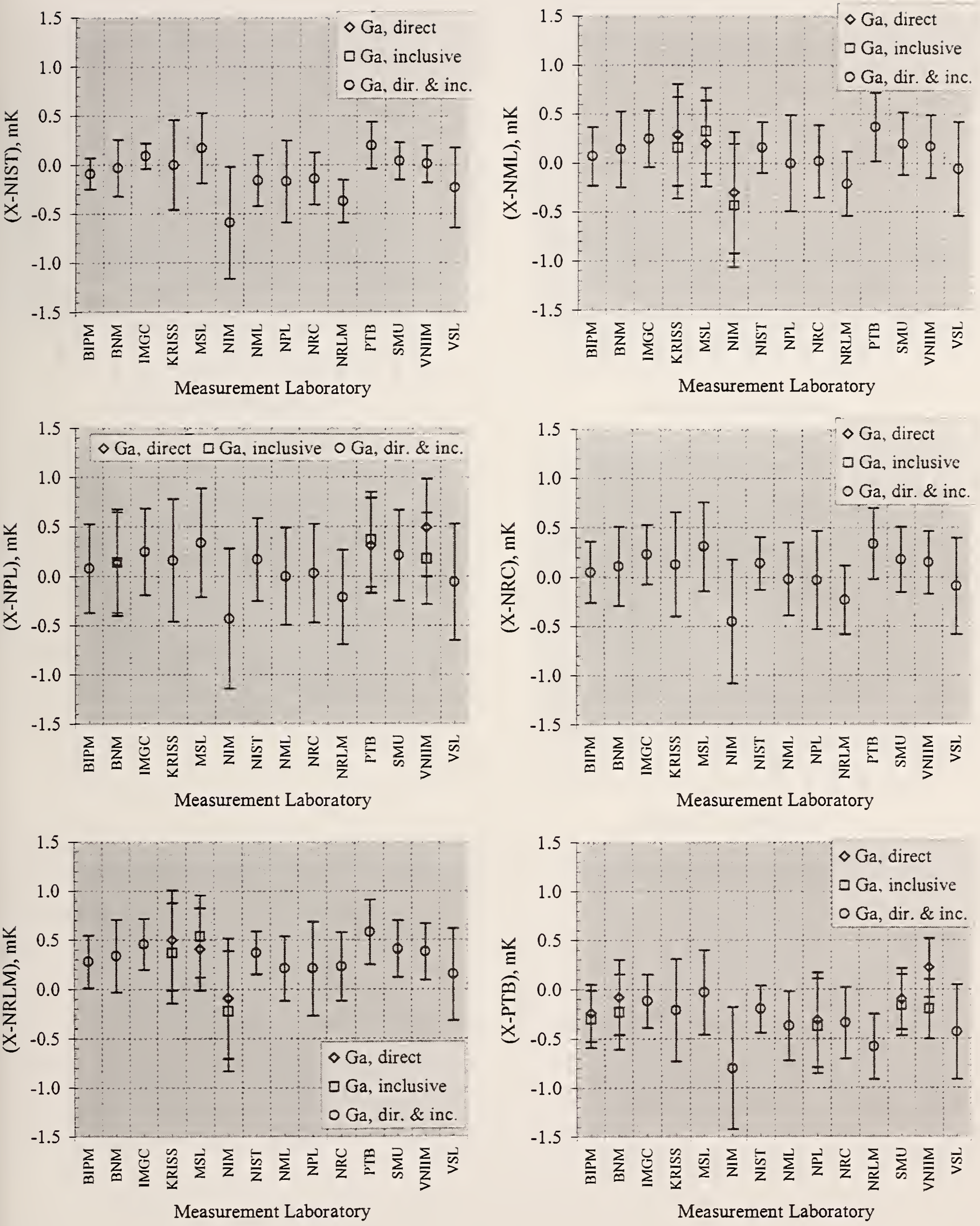


Figure 21. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the Ga melting point. (continued)

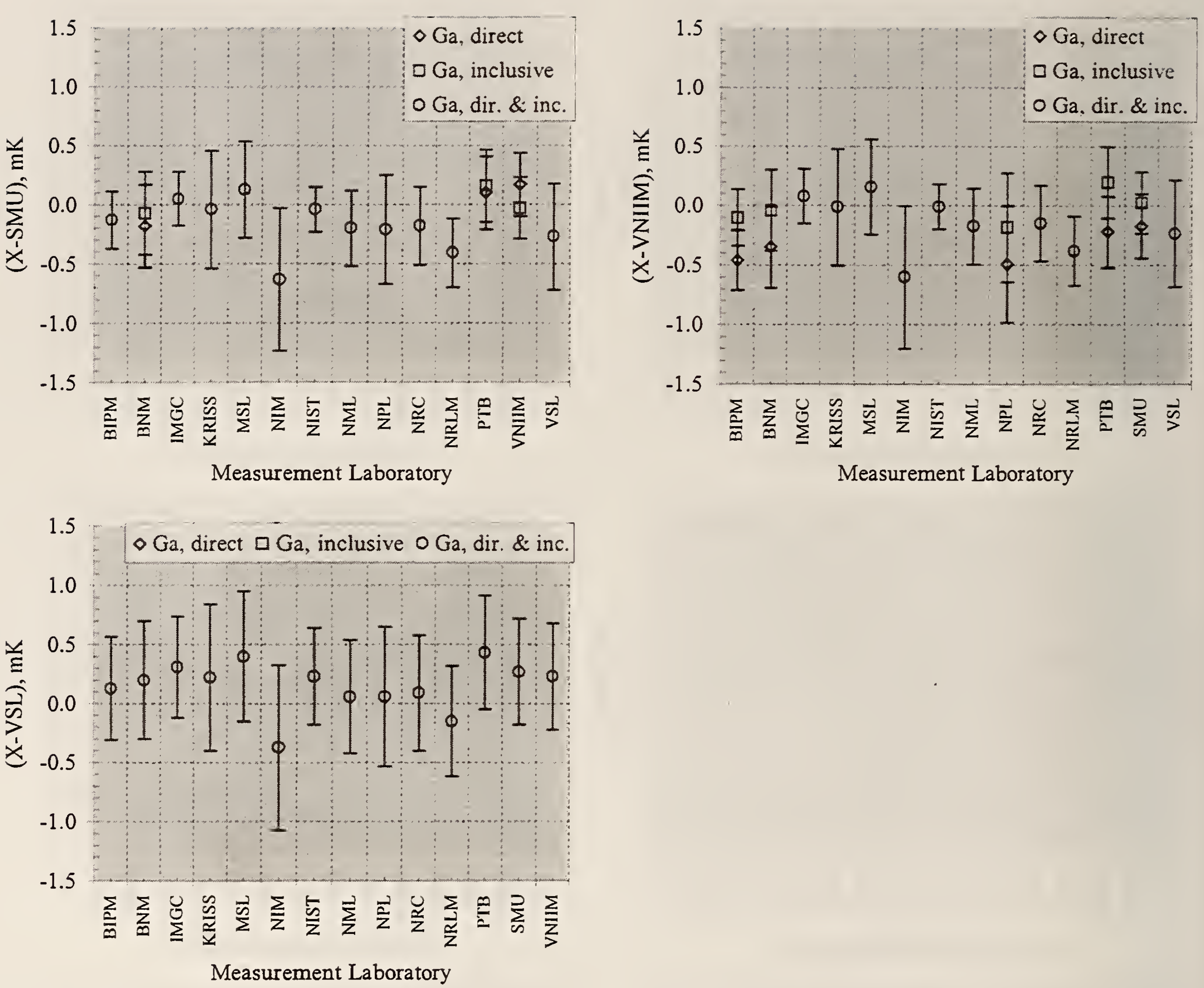


Figure 21. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the Ga melting point. (continued)

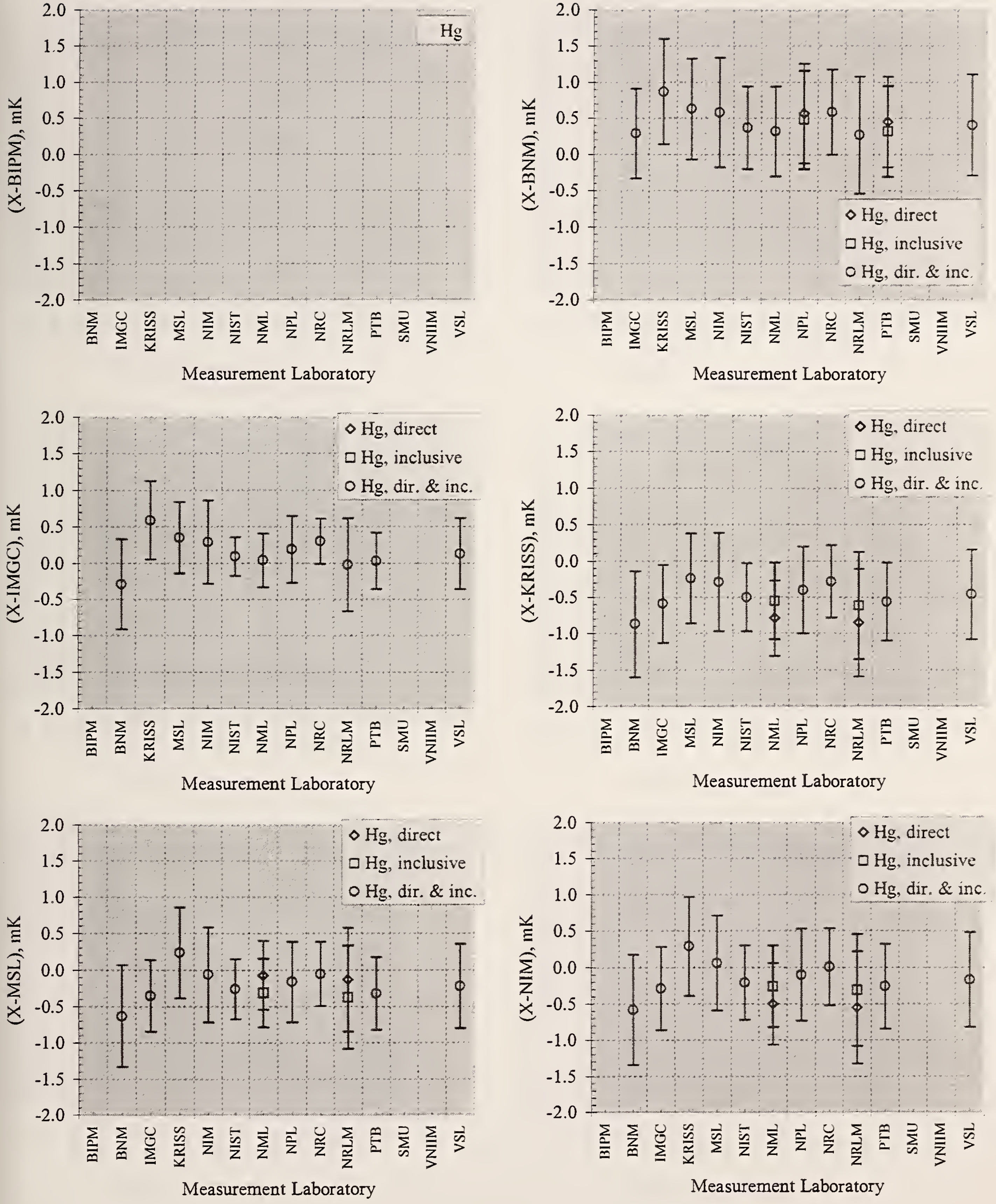


Figure 22. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the Hg triple point.

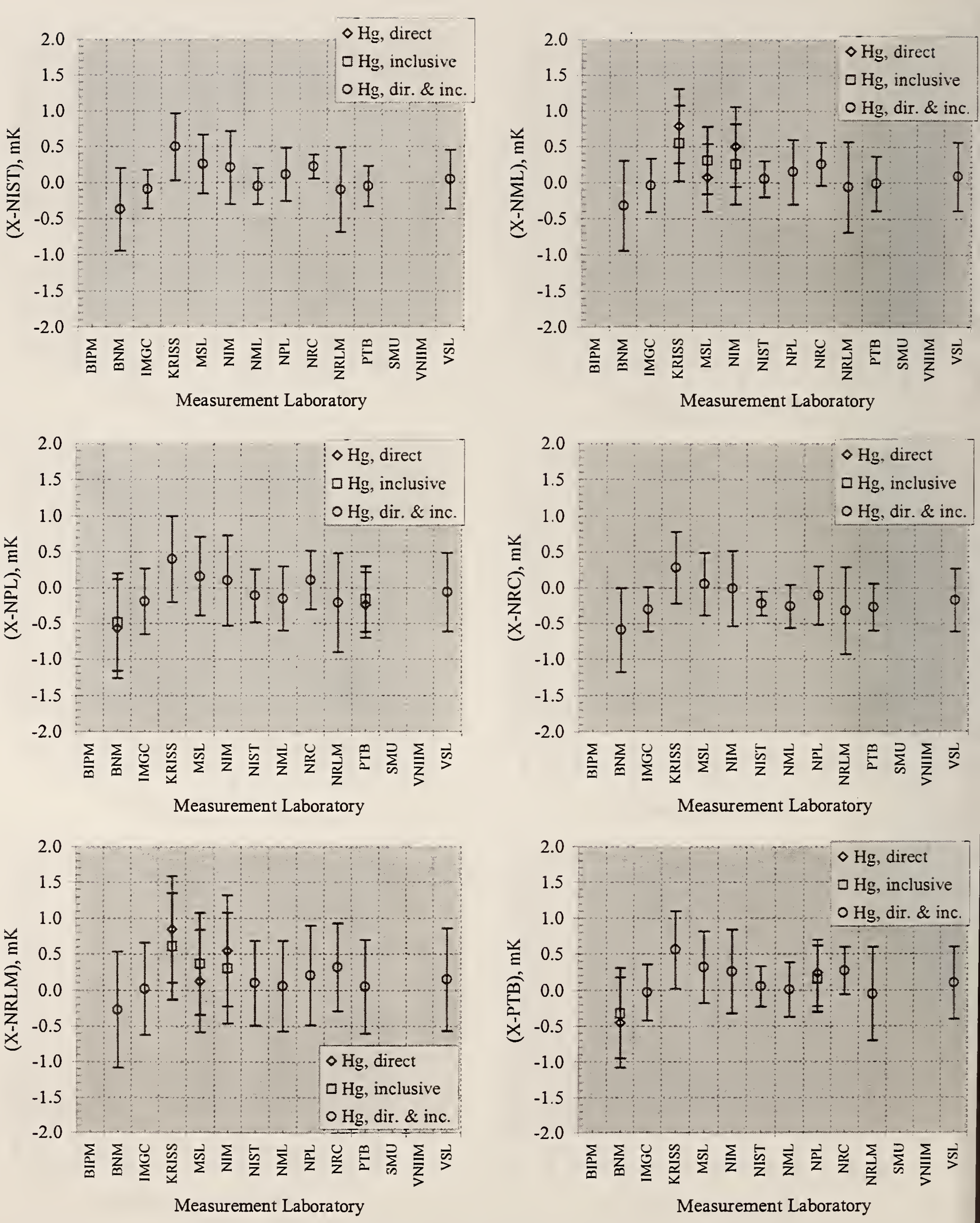


Figure 22. Difference, with *U* (95 %), s in ITS-90 realizations between laboratories at the Hg triple point. (continued)

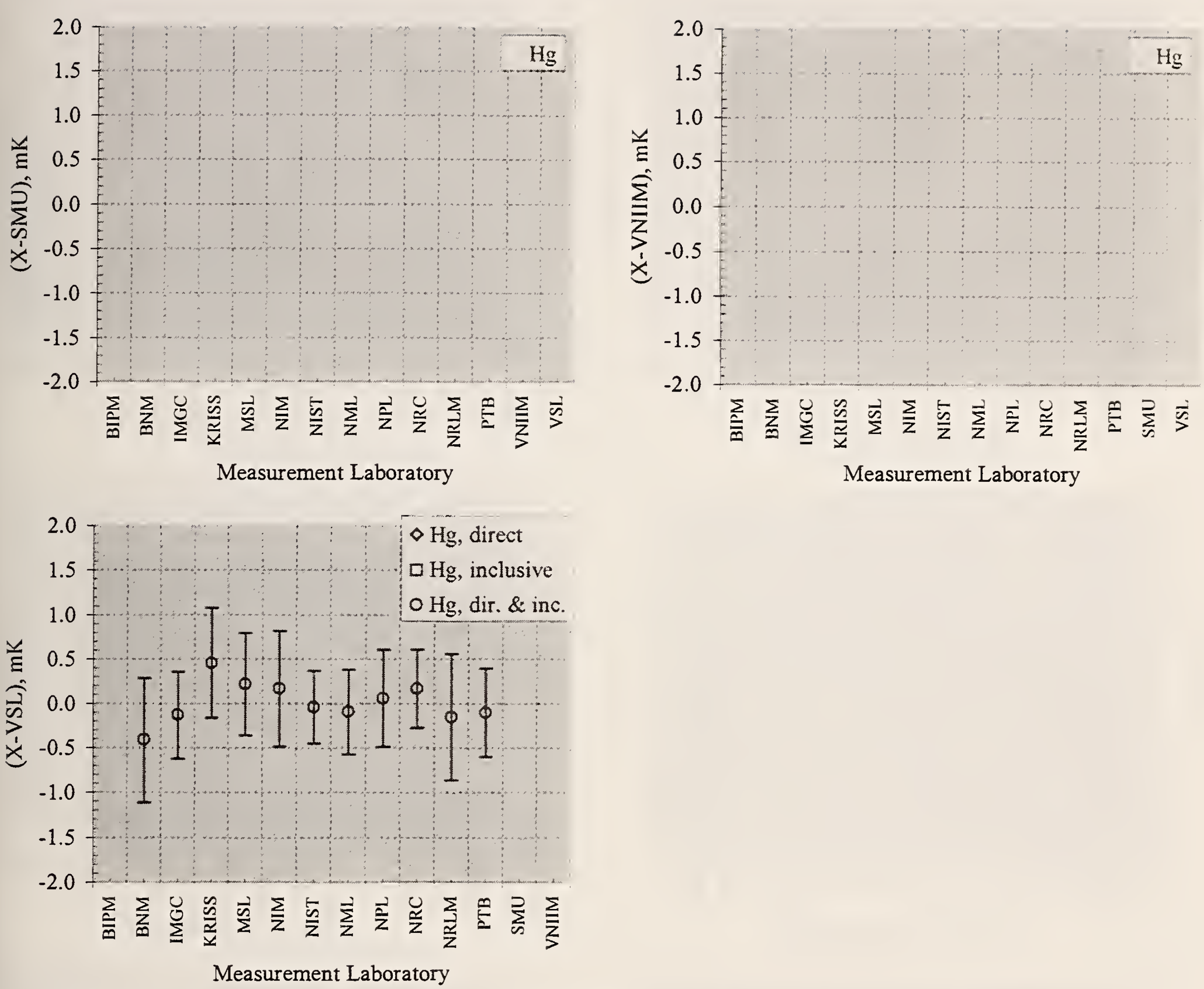


Figure 22. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the Hg triple point. (continued)

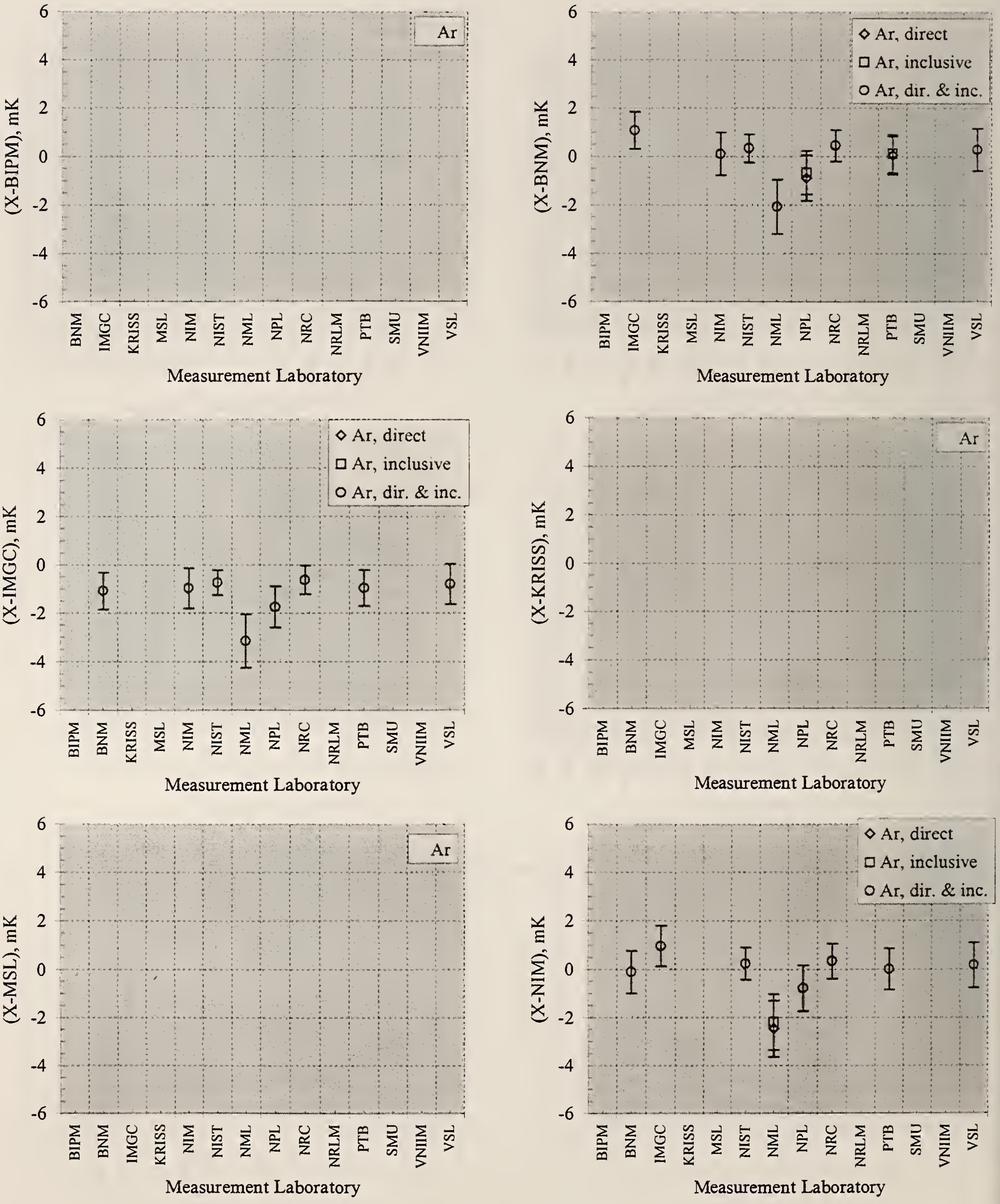


Figure 23. Differences, with *U* (95 %), in ITS-90 realizations between laboratories at the Ar triple point.

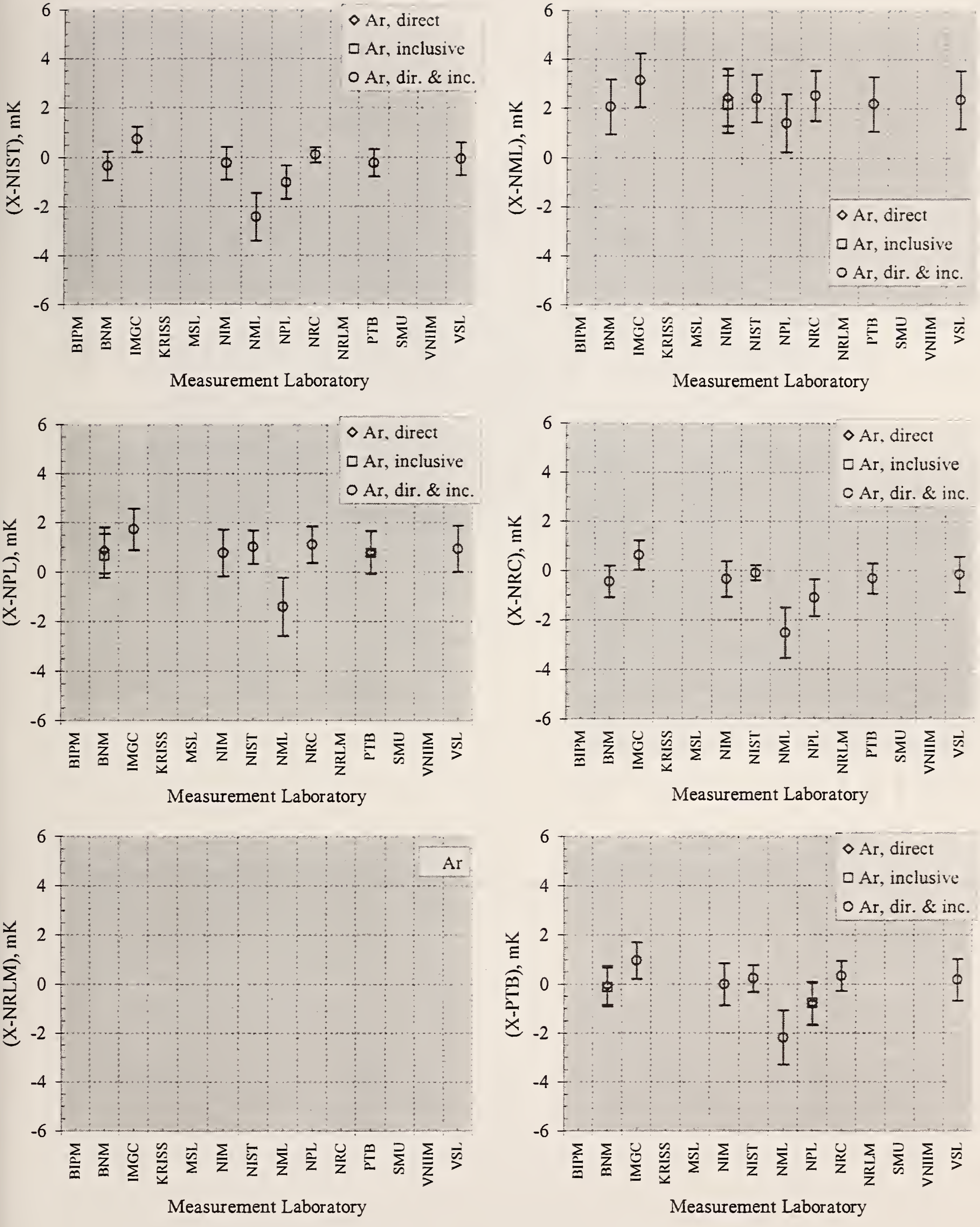


Figure 23. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Ar triple point. (continued)

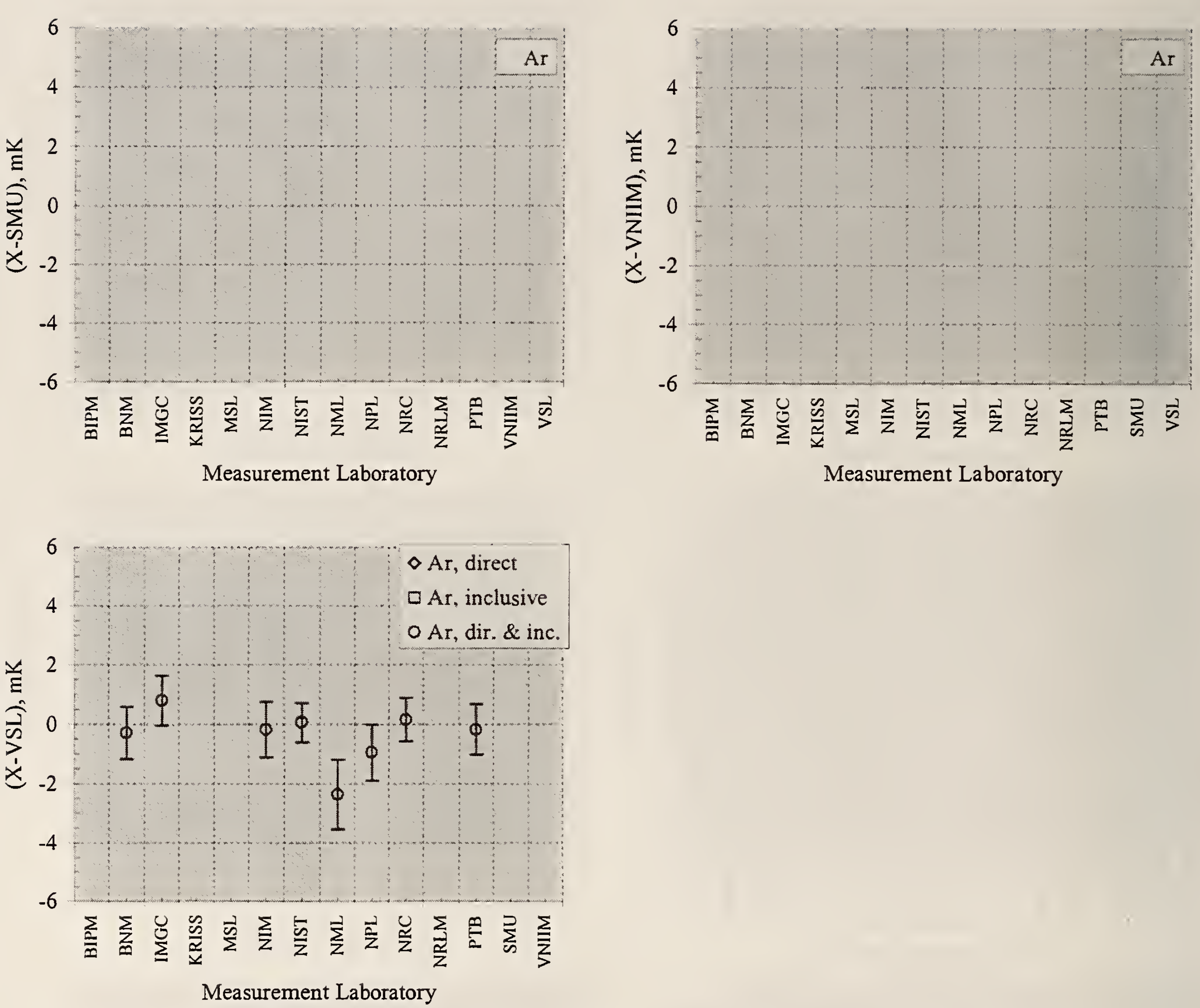


Figure 23. Differences, with U (95 %), in ITS-90 realizations between laboratories at the Ar triple point. (continued)

Figure 24. Direct, indirect and bilateral comparison results for the gallium melting point.

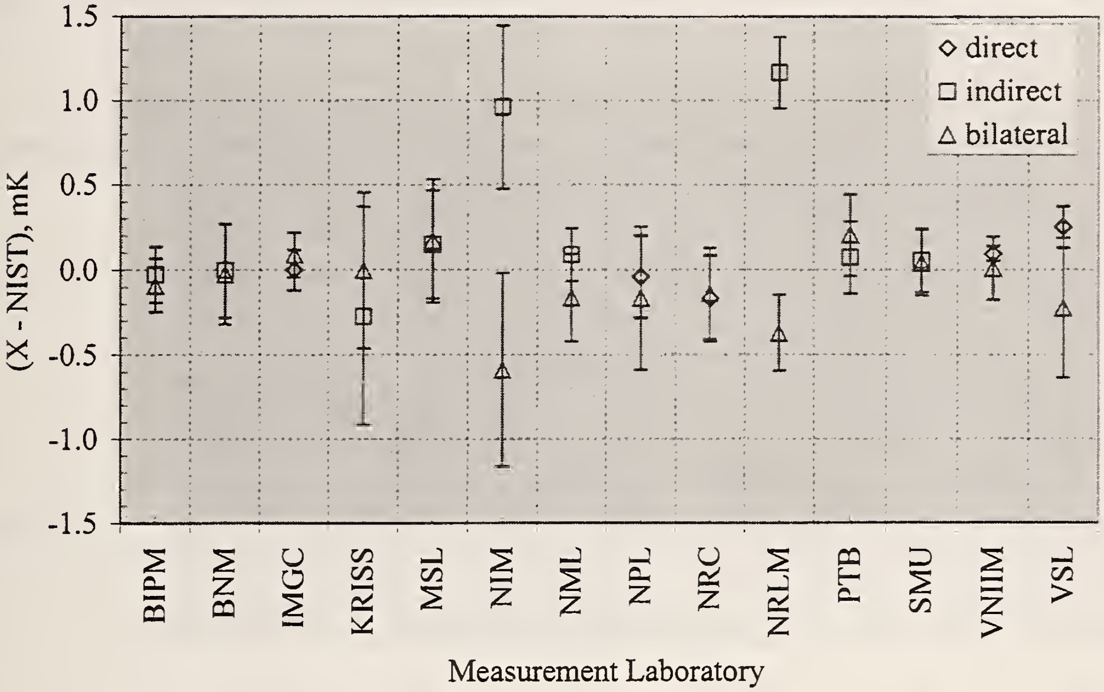
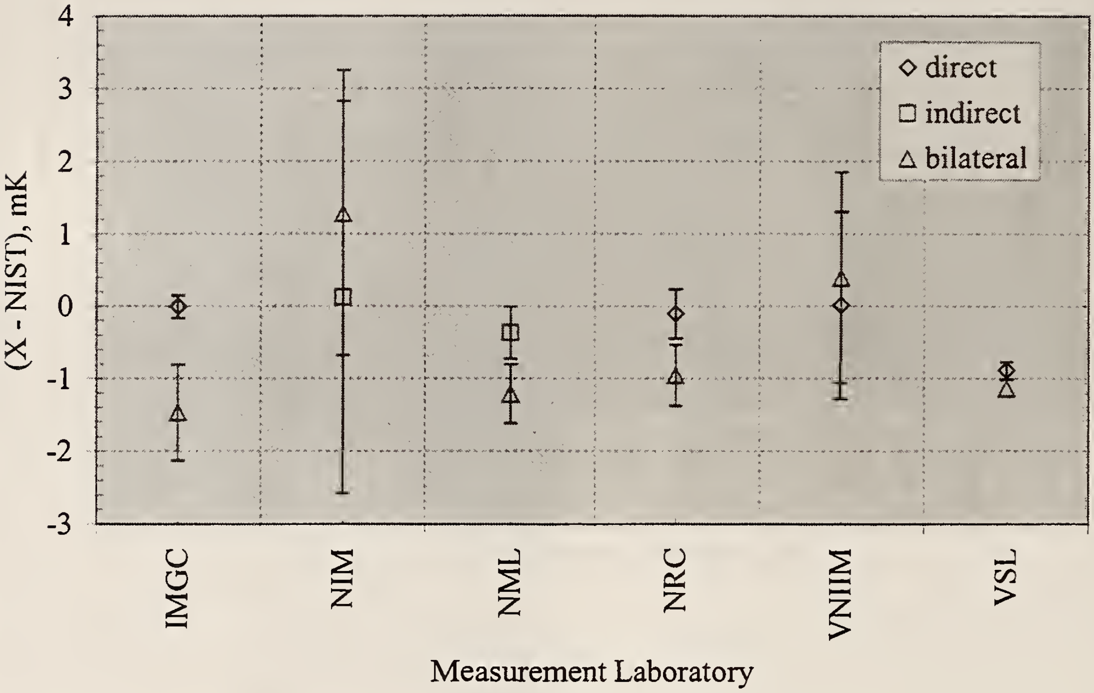


Figure 25. Direct, indirect and bilateral comparison results for the cadmium freezing point.



APPENDIX I

Instructions Provided to Participants.

Note: Documents 1 and 2 referred to below are not included in this Report on Key Comparison 3.

PROCEDURES TO BE FOLLOWED BY THOSE PARTICIPATING IN THE CCT-ORGANIZED, AND NIST COORDINATED, COMPARISON OF REALIZATIONS OF THE ITS-90 OVER THE RANGE 83.8058 K TO 933.473 K

B. W. MANGUM
THERMOMETRY GROUP
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
GAITHERSBURG, MD 20899-0001

NOTE: TRANSFER CELLS OF GALLIUM AND CADMIUM ARE SEALED AND MUST NOT BE OPENED. KEEP CELLS UPRIGHT AT ALL TIMES.

FOR THE GALLIUM AND CADMIUM TRANSFER CELLS:

The distance from bottom of well to liquid level of molten metal is 20.5 cm.

The transfer SPRT immersion depth (sensor midpoint to liquid level for SPRT 162 CE) is 18 cm.

Dimensions of the Cd cell: o.d. = 50.0 ± 0.2 mm; length = 460 ± 1 mm
Dimensions of the Ga cell: o.d. = 51.0 ± 0.2 mm; length = 300 ± 1 mm

THE IMMERSION HEATER (WITH AN ATTACHED THERMISTOR) IS TO BE USED IN FORMING THE INNER MELT IN THE GALLIUM TRIPLE-POINT TRANSFER CELL

The instructions and procedures given below must be followed by the participants in the comparison of realizations of the ITS-90 by the national laboratories. They must have the capability and competence to realize the scale, as it is defined, at the highest level of accuracy.

Before proceeding with the detailed instructions given below, read the enclosed document "Document 1. Criteria and recommendations for optimal realization of the fixed points argon through aluminum of the ITS-90" (hereafter, called Doc. 1) to make sure that you realize, or will realize for this intercomparison, the ITS-90 according to the requirements given in that document. Also, read the other enclosed document, "Document 2. Recommendations for intercomparisons of fixed-point cells of gallium and of cadmium at the highest level of accuracy," (hereafter, called Doc. 2) to make sure that you have the capability, and are willing, to make intercomparisons of the Ga (and Cd, if you have a high-purity Cd cell) in the way specified therein.

The range of temperature covered in this comparison is from the triple point of Ar (83.8058 K) through the freezing point of Al (933.473 K), using a long-stem SPRT and two fixed-point cells. The cells to be intercompared are a Ga transfer (or traveling) triple-point cell and a Cd transfer freezing-point cell [if the host laboratory has a high-purity (at least 99.9999% pure) Cd cell]. The comparison of the transfer and host Ga cells will give valuable information on the reproducibility of high-purity Ga cells and the realization of this defining fixed point in the various national metrology laboratories. This is of particular importance in regard to discussions of using the Ga melting point as a possible replacement for the triple point of water (TPW). The comparison of the Cd cells also will give valuable information on the reproducibility of this fixed point, which can be used as a check point for calibrations and as one measure of the non-uniqueness of the ITS-90 between Sn and Zn. The SPRT traveling with the Ga and Cd fixed-point cells is to be measured at the TPW, at the Ga triple-point temperature in the Ga transfer cell and then again at the TPW. Then the SPRT is to be annealed and calibrated at all of the fixed points in the range of comparison, i.e., measurements at TPW, Al, TPW, Zn, TPW, Cd, TPW, Sn, TPW, In, TPW, Ga, TPW, Hg, TPW, Ar and TPW, in that order. If an Ar triple-point cell for long-stem SPRTs is not available, then the host laboratory may perform the comparison over the limited range from the Hg triple point to the freezing point of Al. If neither an Ar triple-point cell nor a Hg triple-point cell is available, then the host laboratory may perform the comparison over the more limited range from the TPW to the freezing point of Al. Similarly, if the host laboratory does not have an Al freezing-point cell, then the upper temperature of the comparison will terminate at the Zn freezing point.

DETAILED INSTRUCTIONS FOR PARTICIPATING LABORATORIES

1. Upon receipt of the SPRT and the two transfer cells, the host laboratory must inspect the devices for damage. Then, the host must call the coordinating laboratory, or the regional sub-coordinating laboratory, as the case may be, to report the condition of the devices. If there is damage, the sub-coordinating laboratory will give instructions on how to proceed.

2. If no damage has been sustained and after reporting to the sub-coordinating laboratory, the host must make measurements of the transfer SPRT at two measuring currents (in order to determine the zero-power value) in a TPW cell and in the Ga transfer cell. The ice mantle of the TPW cell must have been prepared, i.e., aged, according to the instructions in Doc. 1. Also, the triple point of Ga must have been prepared as indicated in Doc. 1.

3. After completing measurements according to instruction 2, the 0 mA resistance values of the transfer SPRT at the TPW and at the Ga triple point, and the W value (for the triple-point temperature) for the Ga transfer cell must be communicated to the sub-coordinating laboratory before proceeding. After receiving this information, the sub-coordinating laboratory will advise the host laboratory as to the next step to be taken.

4. Following the completion of instruction 3 and after receiving approval from the sub-coordinating laboratory to proceed with the comparison, the host laboratory (if it has an Al

freezing-point cell) must slowly insert the transfer SPRT into an annealing furnace at a temperature that is no greater than 500 °C and then increase the temperature of the furnace and SPRT to approximately 675 °C over about 45 minutes. After the furnace and SPRT have reached a temperature of approximately 675 °C, maintain them at that temperature for four hours. Then, reduce the temperature of the furnace and SPRT to 500 °C over at least a three-hour period (that is, reduce the temperature at a rate of about 1 °C/h). Once the temperature of the furnace and the SPRT have been cooled to 500 °C, slowly remove the SPRT from the furnace directly to the room environment. After the SPRT has cooled to room temperature, measure its resistance at the TPW, then at the Ga point in the Ga transfer cell, and then again at the TPW, all as specified in Doc. 1.

5. If the host laboratory does not possess an Al freezing-point cell, then following the completion of instruction 3 and after receiving approval from the (sub)coordinating laboratory to proceed with the comparison, the host laboratory must slowly insert the transfer SPRT into an annealing furnace at about 500 °C and maintain it at that temperature for four hours. After this annealing, slowly remove the SPRT from the furnace directly to the room environment. After the SPRT has cooled to room temperature, measure its resistance at the TPW, at the Ga point in the Ga transfer cell, and then again at the TPW, all as specified in Doc. 1.

6. If the decrease in the resistance of the SPRT at either the TPW or the Ga triple point, as measured according to instructions 2 and 4 or 2 and 5, is equivalent to 0.5 mK or greater, repeat instruction 4 or 5, as appropriate. If the decrease at both of the fixed points is less than 0.5 mK, proceed to instruction 8.

7. After repeating instruction 4 or 5, as appropriate, the additional decrease in the resistance of the SPRT at either of these fixed points should be equal to or less than 0.2 mK. If the differences in the values are larger than 0.2 mK, communicate with the (sub)coordinating laboratory for further instructions.

8. After annealing and measurements at the TPW, at the triple point of Ga, and then again at the TPW, calibrate the SPRT over the entire range, starting at the Al point (or at the Zn point, if the Al point is not available). Follow Doc. 1 for realizing each of the fixed points. After measurements at two currents at each of the fixed points, make measurements at two measuring currents at the TPW. Determine the W value (using zero-power values of R) for each fixed point, using the TPW value obtained immediately following the measurements at the other fixed point.

9. After completion of the calibration of the SPRT, the Ga transfer cell must be compared with the Ga cell of the host laboratory, according to Doc. 2.

10. Following the comparison of the Ga cells, the Cd transfer cell must be compared with the Cd cell of the host laboratory, according to Doc. 2, if the host laboratory owns a Cd cell.

11. After completing all of the above measurements, the host laboratory must transmit the data and computations to the sub-coordinating laboratory.

12. After receiving notice from the sub-coordinating laboratory, the host laboratory must return the devices to the (sub)coordinating laboratory.

13. The host laboratory must complete all of the measurements and return the SPRT and the Ga and Cd cells to the sub-coordinating laboratory within 8 weeks of the receipt of the devices.

14. With regard to the transport of the transfer cells and SPRT, they will be sent, or hand carried, by the sub-coordinator to a participant. The preferred method of transfer between the sub-coordinator and the participating laboratories is hand-carry, when that is possible. Upon completion of the measurements, the participating laboratory must return the transfer cells and SPRT to the sub-coordinator, using the same method that was employed to get the transfer cells and SPRT to the participant.

    The transfer cells and SPRT must be insured, if the devices are not hand carried. This will be the responsibility of the sub-coordinators. The amount of insurance should be: US$10,000 for the Ga cell, US$12,000 for the Cd cell and US$8,000 for the SPRT.

    Attached to each container for the transfer cells and for the SPRT must be an ATA carnet, which consists of several forms relating to the exportation and importation of the transfer devices. The procedures required by the various countries' Customs must be obeyed strictly. The carnet forms must be completed carefully and accurately. This is the responsibility of the laboratory doing the shipping or carrying the devices to the other laboratory. The receiving laboratory must check the carnet forms very carefully upon receipt.

    For those involved in comparisons with PTB, some kind of pro-forma quotation is required by EC customs regulations. That will be arranged by PTB.

REQUIREMENTS FOR PARTICIPATING LABORATORIES CONCERNING REPORTING OF DATA TO THE SUB-COORDINATING LABORATORY

The participating host laboratory must send to the sub-coordinating laboratory the following:

1. Immersion curves of SPRT(s) (belonging to the host laboratory) in each of the host's fixed-point cells that will be involved in the measurements associated with this intercomparison of realizations of the ITS-90.

2. Immersion depth (and correction, in mK) of the transfer SPRT in each fixed-point cell, including the TPW cell, that was used in this intercomparison of realizations of the ITS-90.

3. Freezing curves for In, Sn, Cd, Zn and Al cells and melting curves for Ar, Hg and Ga cells that belong to the host laboratory. These are to have been obtained before receipt of the transfer SPRT and transfer fixed-point cells.

4. Melting and freezing curves of the Cd transfer cell and melting curve of the Ga transfer cell.

5. Resistance values of the SPRT in each of the fixed-point cells, and in the TPW cell obtained following the measurements in each of those other fixed-point cells.

6. Values of $W = R(T$ in fixed-point cell$)/R(273.16\ \mathrm{K})$. Note: $R(273.16\ \mathrm{K})$ is the resistance at 273.16 K, i.e., the value corrected for the hydrostatic head in the TPW cell, and *NOT* the value directly obtained with the SPRT in the TPW cell.

7. Values of $W = \mathrm{R}($defining T of fixed-point$)/R(273.16\ \mathrm{K})$. Note: $R(273.16\ \mathrm{K})$ is the resistance at 273.16 K, i.e., the value corrected for the hydrostatic head in the TPW cell, and *NOT* the value directly obtained with the SPRT in the TPW cell. Also, $R($defining T of fixed-point) is the resistance value at the defining fixed-point temperature and NOT the resistance value directly obtained with the SPRT in the fixed-point cell.

8. The resistances of the SPRT at the host TPW cell temperature and at the triple-point temperature of the Ga transfer cell, all obtained upon receipt of the SPRT and the transfer cells.

9. The type of resistance bridge used in the measurements.

10. The type of reference resistor used with the resistance bridge and whether or not it is temperature controlled.

11. If the host's fixed-point cells are from a commercial source, the name of the manufacturers and the model numbers of the cells must be given (the manufacturer's name will not appear in print).

12. If, contrary to Document 1, a sealed 'transfer' cell, owned by the host laboratory, is used in the measurements, then that fact must be reported to the sub-coordinating laboratory and the data giving the comparison of that sealed cell with an open cell must be provided.

13. Submit a progress report to the sub-coordinator at the end of four (4) weeks following receipt of transfer cells and SPRT. This is to be done by e-mail.

14. Send to the coordinating laboratory (NIST) a copy of everything sent to the sub-coordinating laboratory. This also will be done by e-mail, except for curves (freezing, melting, immersion) of data. Those curves are to be sent by Air Mail.

APPENDIX II

Instrumentation and experimental details

This appendix contains details of the participants' instrumentation and fixed-point cells, techniques of nucleation of freezes or preparation of melts, duration of those freezes or melts, etc.

In this Appendix II we present the information on these topics that was provided by the various participants. Details of the various participants' instrumentation are given in Table II.1. In Table II.2, we give details of the participants' fixed-point crucibles or containers and of their furnaces or baths. In Table II.3, we give details of the participants' techniques of nucleation of freezes or preparation of melts. Also, in this table, we list the duration of those freezes or melts.

Table II.1	Details of participants' instrumentation used in key comparison 3.
Table II.2.	Details of participants' Al, Zn, Cd, Sn, In, Ga, TPW, Hg and Ar cells and their respective cryostats, furnaces, baths, etc.
Table II.3.	Details on participants' techniques of realization of the triple-point, melting-point or freezing-point temperature of the various fixed points.

Table II.1. Details of participants' instrumentation used in key comparison 3.

Laboratory	**NIST**	**NML**		**PTB**	**VNIIM**	**BNM-INM**	**SMU**	**NPL**	**BIPM**
Bridge Manufacturer	ASL Model F18	ASL Model F18	ASL Model F18	ASL Model F18	Guildline 9975	Guildline	ASL Model F18	ASL Model F18	Guildline 9975
AC/DC	AC	AC	AC	AC	DC	DC	AC	AC	DC
If AC, give		F18/1	F18/2						
Frequency	30 Hz	75 Hz	75 Hz	25 Hz			75 Hz	25 Hz or 75 Hz	
Band width	0.1 Hz	0.1 Hz	0.1 Hz	0.1 Hz			0.1 Hz	0.1 Hz or 0.5 Hz	
Gain	10^{4}	10^{4}	10^{4}	10^{4}			10^{4}	5×10^{4}	
Quad gain	10	10	10	10			10	100	
Read manually or off IEEE-488	IEEE - 488	IEEE	IEEE	IEEE			IEEE-488	IEEE (mostly)	
Normal measurement current	1 mA	1mA	1mA	1 mA			1 mA	1 mA	
Self-heating currents	1.414 mA	1.414 mA	1.414 mA	1,414 mA			1.414 mA	1,414 mA	
Unity reading	1			1,0000000			<0.1 ppm	1 digit	
Zero reading	0			0,0000000			<0.1 ppm	1 digit	
Compliments check error	< 1 • 10 -7			o.k.			<0.1 ppm	2 digits	
If DC, give									
Gain					1000	X30 or x100			Galvanometer sensitivity: x 30
Period of reversal					4 s	4 s			4 s
Read manually, off strip chart , or off IEEE-488					manually	strip chart			Strip chart
Reference resistor type	Wilkins type 5685A - 100 Ω	9330	CHT-4	AC/DC 5685A	MC3020	10 ohms	25 Ω 5649A 100 Ω 5685A	AC/DC Wilkins pattern, 100 Ω	nominal value:10 Ω, Type: 5684 B
Reference resistor mfg.	Tinsley	Guildline	Julie	Tinsley	Association "Priborostroiteli", Russia	Guildline	Tinsley	H Tinsley & Co Ltd.	Tinsley
Reference resistor - how maintained	calibrated by NIST Electricity Division; kept in oil bath	20.0 °C oil bath	Lagged Box	stirred oil bath	oil bath 25 °C ±0.005 °C	Liquid bath	in oil with stabilized temperature	in oil bath	Traceable to BIPM quantum Hall effect (QHE)
Reference resistor - temperature control	oil bath, ±8 mK	Controller	Room Temperature (21.0 °C)	Thamson-thermostat	prt	25 °C	yes	0.1 °C	Room control ± 0.2 °C and corrections for temp. drift are made
Reference resistor - temperature coefficient	0.5 ppm/°C @ 25 °C		0.6 ppm/°C	2.25 ppm/K	3×10^{-7} Ohm/ °C	less than 1ppm/°C	100 Ω: $\alpha=9\times10^{-7}$ K^{-1}	0.7 and 0.5×10^{-6}/°C	-1.053×10^{-6} K^{-1}
RBC evaluation of resistance bridge	Yes	2×10^{-8}	4×10^{-8}			not possible	yes	Yes	Yes, RBC 100
RBC evaluation result of linearity of resistance bridge	$2.8 \cdot 10^{-8}$			7.0×10^{-8}	6.3×10^{-8}	applied, correction not required	4×10^{-8}	3.5×10^{-8} and 5.6×10^{-8}	7.4×10^{-8}
Normal std. dev. of measurement set with RBC	6×10^{-7} with n=25	2×10^{-8}	4×10^{-8}	4.3×10^{-8}	7×10^{-8}	5×10^{-7}	0.05 ppm	2.1×10^{-7} and 1.1×10^{-7}	2.5×10^{-7}

Table II.1. Details of participants' instrumentation used in key comparison 3. (continued).

Laboratory	NRC	NMI/VSL		IMGC	MSL	NRLM	NIM		KRISS
Bridge Manufacturer	ASL Model F18	ASL Model F18		ASL Model F18	ASL Model F18	ASL Model F18	ASL Model F18	Guildline 9975	ASL
AC/DC	AC	AC		AC	AC	AC			AC
If AC, give									
Frequency	90 Hz, check for difference with 30 Hz	75 Hz		25 Hz	75 Hz	25Hz (75Hz is used only to see AC/DC effect)	25 Hz		30 Hz
Band width	0.1 Hz	0.1 Hz		0,1 Hz	0.1 Hz	0.1Hz	0.1 Hz		0.1 Hz
Gain	10^4	10^4		10^4	10^4	10^4	10^4		10^4
Quad gain	10	1 or 10, regularly 1 for these types of PRT's		10	10	1			1
Read manually or off IEEE-488	IEEE-488	IEEE		IEEE - 488	IEEE-488	IEEE-488	manually		IEEE-488
Normal measurement current	1 mA	1 mA		1,41 mA	1 mA	1mA	1mA		1.0 mA
Self-heating currents	1.414 mA	1.414 mA		2,0 mA	1.414 mA	0.5, 0.5sqr(2),1, sqrt(2) mA	1.414 mA		1.414 mA
Unity reading	1	within one lsf from 1		1	0.999 999 8	0.999 999 94	1.000 000		1
Zero reading	0	within one lsf from 0		0	0.000 000 4 IEEE-488	0.000 000 002	0.000 000		0.000 000 03
Compliments check error	0.0000001			$1 \cdot 10^{-7}$		0.000 000 15			0.4 ppm
If DC, give		NA							
Gain	n/a							Al - Hg: x 100, Ar: x 30	
Period of reversal	n/a							4 s	
Read manually, off strip chart, or off IEEE-488	n/a							manually	
Reference resistor type	5685	Wilkins = 5684		5685A - 100 Ω	5685S – 100 Ω	Wilkins(5685A)	P321, BZ13, BZ3		AC/DC
Reference resistor mfg.	Tinsley	Tinsley		Tinsley	Tinsley	Tinsley	USSR, China		Tinsley
Reference resistor - how maintained	Guildline 9732 VT oil bath	in temperature-controlled oil bath		Referred to IEN std	stirred oil bath	Thermostated oil bath	Al - Ga: standard controlled temperature box with air, Ar and Hg: oil bath		Oil bath
Reference resistor - temperature control	± 2 mK	yes, at 28 °C		Tinsley type 5648	29.5 °C, ±5 mK	30mK pk-pk	at 20 °C		0.01 °C
Reference resistor - temperature coefficient	1.75 ppm/°C	2 ppm /K		< 3 ppm/°C	–3.2 ppm/°C	-1 ppm/°C (25 Ω) , -1 ppm/°C (100 Ω)	100 ohm resistor (for Al only) -	10 Ω for Ga to Zn: 3.85 x 10^{-6}/°C; 10 Ω for Ar and Hg: 2.0 x 10^{-6}/°C	+1.25 ppm/°C
RBC evaluation of resistance bridge	Yes	bridge 1	bridge 2	Yes	Yes	Yes	Yes	Yes	Yes
RBC evaluation result of linearity of resistance bridge	6.85 x 10^{-8}	1.7 x 10^{-7}	8.5 x 10^{-8}	3.23 x 10^{-8}	1s = 4x10^{-8}, n=20, no crrctn.	6.31 x 10^{-8}			4.31 x 10^{-8}
Normal std. dev. of measurement set with RBC	2.2 x 10^{-7}	8.9 x 10^{-8}	3.6 x 10^{-8}	$3.5 \cdot 10^{-8}$	1s = 2x10^{-8}, n=20, w/crrtn.	6.4 x 10^{-8}	4.7 x 10^{-8}	7.7 x 10^{-7} with n = 29 to 1.3 x 10^{-6} with n = 29	0.03 ppm

Table II.2. 1. Details of participant's Al cells and their respective furnaces, etc.

	NIST	NML	PTB		VNIIM	BNM-INM	SMU
Cell commercial/Lab made	lab made	lab made	lab made (HN)	commercial	lab made	INM	commercial
Crucible material (graphite, etc.)	Graphite	graphite	graphite	graphite	graphite	graphite	graphite
Source	Ultra Carbon	Ultracarbon		Isotech	Russia	Carbone Lorraine	Carbone of Amer.
Purity/how purified	<5 ppm, F treated	After manu			99,9999% (certificate)	99.9995%	99.9997%
Length / cm	24.4	30.0	22	22	28.0	21.0	28.2
Diameter / mm	43	45	42	42	38	34	48
Thermometer well material	Graphite & SiO_2	C/quartz	graphite/quartz	graphite/quartz	graphite	silica	Graphite/ quartz
Thermometer well ID / mm	8	8	8	8	12	7.5	8
Metal sample source	Johnson Matthey (Spokane)	Johnson Matthey (Spokane)			Russia	Johnson Matthey	Johnson Matthey
Metal sample purity	99.999 96 %	99.9999 %	99.9999 %	99.9999 %	99.9999 %	99.9999 %	99.9999%
Metal sample weight / kg	0.36	0.505	0.360		0.453	0.350	0.35
Crucible container material	cell: SiO_2, cell holder: Inconel	Quartz glass	quartz	quartz	quartz	silica	cell: SiO_2, cell holder: Inconel
Open or closed cell	Open	open	sealed	closed	open	closed	closed
Pressure in cell / kPa	101.325	bled 1 atm Ar			(101.325± 0.100) Pa	101.325	81.883
Immersion depth of SPRT / cm	18		16	17.0	20.0	17.0	17.5/17.0
Crucible container OD / mm	SiO_2 cell: 48, Inconel holder: 51	51	48	48	52	49	54
Furnace details							
Furnace or bath?	furnace	furnace	furnace	furnace	furnace	furnace	furnace
Commercial/Lab made	lab made	lab made	commercial	commercial	lab made	lab made	comm.
DC or AC heater power	dc	ac	dc	ac	ac heater	ac	AC
Furnace control type	Automatic	Variac	Gero	Eurotherm	Lab made	PID	PI
Furnace controlled by temperature sensor or by power settings	temperature sensor	Power	controller	controller	temperature sensor	sensor	temp. sensor
Temperature stability over 16 hrs (mK)	±8		< 100	< 100	100	100	<100
How many zones in furnace	2	3	2	1	three zones	1	3
Heat pipe liner/working material	sodium heat pipe	n/a	sodium heat pipe	sodium heat pipe	-	sodium heat pipe	
Uniformity in furnace (without cell)		<0.01 °C/cm			-		<0.1 K
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	8 mK range			20 mK	0.01 K	0.1°C	0.05

Table II.2.1. Details of participant's Al cells and their respective furnaces, etc. (continued).

	NPL	BIPM	NRC	NMi/VSL	IMGC	MSL
Cell commercial/Lab made	lab made	no cells	lab made	lab made	lab made	no cells
Crucible material (graphite, etc.)	Graphite		graphite	high density graphite	graphite	
Source	Ringsdorf		Ultra Carbon	LEICO and Cominco	ULTRA CARBON	
Purity/how purified	Baked		10 ppm	99.9999 %	< 5 ppm	
Length / cm	23.4		30	54.0	21.5	
Diameter / mm	43		45	50	44	
Thermometer well material	silica		graphite	graphite out, quartz in	silica	
Thermometer well ID / mm	9		11	7.9	10.8	
Metal sample source	Cominco		JME	LEICO and Cominco	Cominco	
Metal sample purity	99.9999 %		99.9999 %	99.9999 %	99.9999 %	
Metal sample weight / kg	0.237		0.471	0.530	0.350	
Crucible container material	silica		quartz	quartz	silica	
Open or closed cell	open		open	open	open	
Pressure in cell / kPa	101		101.3	101.3 +10.1	101.325	
Immersion depth of SPRT / cm	17.4		21	24.0	16	
Crucible container OD / mm	50		50	44	50	
Furnace details						
Furnace or bath?	furnace		furnace	furnace	Furnace	
Commercial/Lab made	commercial		lab made	lab made	lab made	
DC or AC heater power	ac		dc	dc	ac	
Furnace control type	Thyristor		PID	Eurotherm	Automatic	
Furnace controlled by temperature sensor or by power settings	sensor		sensor	N-type thermocouple	temperature sensor	
Temperature stability over 16 hrs (mK)	50		500	50	50	
How many zones in furnace	1		1	1	1	
Heat pipe liner/working material	sodium heat pipe		sodium heat pipe	sodium heat pipe	Heat pipe liner	
Uniformity in furnace (without cell)	0.2 °C		<0.1 °C	we have not and cannot measure(d) this		
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	not measured		<0.1 °C	< 0.03 °C	within stability	

Table II.2.1. Details of participant's Al cells and their respective furnaces, etc. (continued).

	NRLM	NIM	KRISS
Cell commercial/Lab made	graphite	lab made	lab made
Crucible material (graphite, etc.)		graphite	graphite
Source		NIM	Ultra carbon
Purity/how purified		99.995%	99.999%
Length / cm		24.0	25.5
Diameter / mm		34	44
Thermometer well material		quartz	graphite
Thermometer well ID / mm		8	11
Metal sample source		China	Johnson Matthey
Metal sample purity		99.9999 %	99.9999 %
Metal sample weight / kg		0.350	0.5
Crucible container material			Silica glass
Open or closed cell		closed	open
Pressure in cell / kPa		101.325	
Immersion depth of SPRT / cm		17.0	16.1
Crucible container OD / mm		50	51
Furnace details			
Furnace or bath?	furnace	furnace	furnace
Commercial/Lab made	lab made	lab made	lab made
DC or AC heater power	dc	ac	ac
Furnace control type		Automatic	PID
Furnace controlled by temperature sensor or by power settings	temperature sensor	temperature sensor	temperature sensor
Temperature stability over 16 hrs (mK)		10	50
How many zones in furnace	yes/NA	3	2
Heat pipe liner/working material			sodium heat pipe
Uniformity in furnace (without cell)		< 0.2 °C	0.1 °C
Temperature distribution over ingot with sample a few kelvins below or above melting temperature		1.5 °C, below	0.01 °C

Table II.2.2. Details of participant's Zn cells and their respective furnaces, etc.

	NIST	NML	PTB	VNIIM	BNM-INM	SMU
Cell commercial/Lab made	lab made	lab made	commercial	lab made	lab made	commercial
Crucible material (graphite, etc.)	graphite	graphite	graphite	graphite	graphite	graphite
Source	ULTRA CARBON	ULTRA CARBON	Isotech	Russia	Carbone Lorraine	Carbone of America
Purity/how purified	<5 ppm, F	After manufacture		99,9999% (certificate)	99.9995%	99.9997%
Length / cm	24.4	21.0	22	24.0	21.0	28.2
Diameter / mm	43	45	42	36	34	48
Thermometer well material	graphite & SiO_2	pyrex	graphite/quartz	graphite	silica	graphite & quartz
Thermometer well ID / mm	8	8	8	12	7.5	8
Metal sample source	Johnson Matthey (Spokane)	Johnson Matthey (Spokane)		Russia	Vieille montagne	Johnson Matthey
Metal sample purity	99.999 968%	99.9999%	99.9999%	99,9999% (certificate)	99.9999%	99.9999%
Metal sample weight / kg	1.03	1.050		0.887	0.850	0.95
Crucible container material	borosilicate	Pyrex	quartz	quartz	silica	quartz
Open or closed cell	open	open	closed/open	open	closed	sealed
Pressure in cell / kPa	101.325	101.3		101.325 ± 0.100	101.325	80.698
Immersion depth of SPRT / cm	18		18.5	17.5	17.0	17.5/17.0
Crucible container OD / mm	50	51	48	52	49	54
Furnace details						
Furnace or bath?	furnace	furnace	furnace	furnace	furnace	furnace
Commercial/Lab made	lab made	lab made	commercial	lab made	lab made	commercial
DC or AC heater power	dc	ac	ac	ac	ac	AC
Furnace control type	Automatic	Variac	Eurotherm	Automatic	PID	PI
Furnace controlled by temperature sensor or by power settings	temperature sensor	Power	controller	temperature sensor	sensor	temperature sensor
Temperature stability over 16 hrs. (mK)	±7		< 100	50	100	
How many zones in furnace	3	3	3	3	1	3
Heat pipe liner/working material	aluminum core	n/a	-	-	air flow furnace	
Uniformity in furnace (without cell)				-		<0.1K
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	8 mK	< 10 mK/cm	6 mK	10 mK	< 100 mK	0.03 K

Table II.2.2. Details of participant's Zn cells and their respective furnaces, etc. (continued).

	NPL	**BIPM**	**NRC**	**NMi/VSL**	**IMGC**	**MSL**
Cell commercial/Lab made	lab made	no cells	lab made	lab made	NIST made	lab made
Crucible material (graphite, etc.)	graphite		graphite	graphite	graphite	graphite
Source	Ringsdorf		Ultra Carbon	Cominco	ULTRA CARBON	Union Carbide
Purity/how purified	Baked		10 ppm	99.9999%	< 5 ppm	<5 ppm
Length / cm	23.4		30	49,0	23.5	20.3
Diameter / mm	43		45	50	44	49.5
Thermometer well material	silica		graphite	graphite out, duran in	silica	quartz + graphite
Thermometer well ID / mm	9		11	7.9	10.8	8
Metal sample source	Johnson Matthey		Cominco	Cominco	Cominco	Koch-Light
Metal sample purity	99.9999%		99.9999%	99.9999%	99.9999%	0.5 mg/kg
Metal sample weight / kg	0.638		1.3	0.995	NIST value	0.824
Crucible container material	pyrex		quartz	duran glass	pyrex	quartz
Open or closed cell	open		open	open	open	open
Pressure in cell / kPa	101		101.325	101.325 + 10.1	101.325	101.325
Immersion depth of SPRT / cm	17.4		22.5	180	18	12.1 to ctr. of sensor
Crucible container OD / mm	50		50	44	50	50
Furnace details						
Furnace or bath?	furnace		furnace	furnace	furnace	furnace
Commercial/Lab made	commercial		lab made	lab made	lab made	lab made
DC or AC heater power	ac		dc	dc	ac	ac
Furnace control type	Thyristor		PID	Eurotherm	Automatic	PID 0-xing
Furnace controlled by temperature sensor or by power settings	sensor		sensor	N-type TC	temperature sensor	temperature
Temperature stability over 16 hrs. (mK)	50		100	50	50	200
How many zones in furnace	3		1	3	1	3
Heat pipe liner/working material			n/a	-	Heat pipe liner	none
Uniformity in furnace (without cell)	200 mK		< 100 mK			200 mK
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	not measured		< 100 mK	< 100 mK	within stability	not measured

Table II.2.2. Details of participant's Zn cells and their respective furnaces, etc. (continued).

	NRLM	NIM	KRISS
Cell commercial/Lab made	commercial	lab made	lab made
Crucible material (graphite, etc.)	graphite	graphite	graphite
Source		NIM	Ultra Carbon
Purity/how purified		99.995%	99.999%/B.V
Length / cm	23.0	24.5	25.5
Diameter / mm	57	41	44
Thermometer well material	quartz	quartz	graphite
Thermometer well ID / mm	8	8	11
Metal sample source		China	Johnson Matthey
Metal sample purity	99.9999%	99.9999%	99.9999%
Metal sample weight / kg	0.502	0.800	1
Crucible container material	quartz		silica glass
Open or closed cell	open	closed	open
Pressure in cell / kPa	101.3±1.0	101.325	
Immersion depth of SPRT / cm	17.0	17.0	14.0
Crucible container OD / mm	64	49	51
Furnace details			
Furnace or bath?	furnace	furnace	furnace
Commercial/Lab made	commercial	furnace	commercial
DC or AC heater power	ac	ac	ac
Furnace control type	PID	Automatic	PID
Furnace controlled by temperature sensor or by power settings	sensor	temperature sensor	temperature sensor
Temperature stability over 16 hrs. (mK)	50 mK, pk-pk	10	10
How many zones in furnace	3	3	3
Heat pipe liner/working material			
Uniformity in furnace (without cell)		< 200 mK	50 mK
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	20 mK, pk-pk	1.5 °C, below	5 mK

Table II.2.3. Details of participant's Cd cells and their respective furnaces, etc.

	NIST	NML	PTB	VNIIM	BNM-INM	SMU
Cell commercial/Lab made	lab made	lab made	no cells	lab made	no cells	no data provided
Crucible material (graphite, etc.)	graphite	graphite		graphite		
Source	ULTRA CARBON	Ultracarbon		Russia		
Purity/how purified	<5 ppm, F	After manufacture		99.9999%		
Length / cm	24.4	21.0		26.0		
Diameter / mm	43	45		36		
Thermometer well material	graphite	Pyrex		graphite		
Thermometer well ID / mm	8	8		12		
Metal sample source	Johnson Matthey (Spokane)	Johnson Matthey (Spokane)		Russia		
Metal sample purity	7N	99.9999%		99.9999%		
Metal sample weight / kg	1.2	1.200		1.150		
Crucible container material	borosilicate	Pyrex		quartz		
Open or closed cell	open	open		open		
Pressure in cell / kPa	101.325	101.325		101.325±0.100		
Immersion depth of SPRT / cm	18			19.0		
Crucible container OD / mm	50	51		52		
Furnace details						
Furnace or bath?	Furnace	Furnace		Furnace		
Commercial/Lab made	lab made	lab made	lab made	lab made		
DC or AC heater power	dc	ac		ac		
Furnace control type	Automatic	Variac		lab made		
Furnace controlled by temperature sensor or by power settings	by temperature sensor	Power		temperature sensor		
Temperature stability over 16 hrs. (mK)	±6			50		
How many zones in furnace	3	3		three zones		
Heat pipe liner/working material	aluminum core	n/a		-		
Uniformity in furnace (without cell)				-		
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	6 mK	<0.01 °C/cm		10 mK		

Table II.2.3. Details of participant's Cd cells and their respective furnaces, etc. (continued).

	NPL	BIPM	NRC	NMi/VSL	IMGC	MSL
Cell commercial/Lab made	no cells	no cells	lab made	lab made	lab made	no cells
Crucible material (graphite, etc.)			graphite	graphite	graphite	
Source			Ultra Carbon	Johnson Matthey / Alpha	ULTRA CARBON	
Purity/how purified			10 ppm	99.9999%	< 5 ppm	
Length / cm			30	49.0	21.5	
Diameter / mm			45	50	44	
Thermometer well material			graphite	graphite out, duran in	silica	
Thermometer well ID / mm			11	7.9	10.8	
Metal sample source			Johnson Matthey	Johnson Matthey / Alpha	Johnson Matthey	
Metal sample purity			99.9999%	99.9999%	99.9999%	
Metal sample weight / kg			1.587	1.214	1.18	
Crucible container material			quartz	duran glass	pyrex	
Open or closed cell			open	open	open	
Pressure in cell / kPa			101.325	101.3+10.1	101.325	
Immersion depth of SPRT / cm			21	20.0	16	
Crucible container OD / mm			50	44	50	
Furnace details						
Furnace or bath?			Furnace	Furnace	Furnace	furnace
Commercial/Lab made			lab made	lab made	lab made	lab made
DC or AC heater power			dc	dc	ac	ac
Furnace control type			PID	Eurotherm	Automatic	PID 0-xing
Furnace controlled by temperature sensor or by power settings			sensor	N-type TC	temperature sensor	temperature
Temperature stability over 16 hrs. (mK)			100	50	50	200
How many zones in furnace			1	3	1	3
Heat pipe liner/working material			n/a	-	Heat pipe liner	none
Uniformity in furnace (without cell)			<100 mK			200 mK
Temperature distribution over ingot with sample a few kelvins below or above melting temperature			<100 mK	<100 mK	within stability	not measured

Table II.2.3. Details of participant's Cd cells and their respective furnaces, etc. (continued).

	NRLM	NIM	KRISS
Cell commercial/Lab made	no cells	lab made	no cells
Crucible material (graphite, etc.)		graphite	
Source		NIM	
Purity/how purified		99.995%	
Length / cm		24.5	
Diameter / mm		41	
Thermometer well material		quartz	
Thermometer well ID / mm		8	
Metal sample source		China	
Metal sample purity		99.9999%	
Metal sample weight / kg		0.800	
Crucible container material			
Open or closed cell		closed	
Pressure in cell / kPa		101.325	
Immersion depth of SPRT / cm		17.0	
Crucible container OD / mm		49	
Furnace details			
Furnace or bath?		Furnace	
Commercial/Lab made		lab made	
DC or AC heater power		ac	
Furnace control type		Automatic	
Furnace controlled by temperature sensor or by power settings		temperature sensor	
Temperature stability over 16 hrs. (mK)		10	
How many zones in furnace		3	
Heat pipe liner/working material			
Uniformity in furnace (without cell)		< 0.2 °C	
Temperature distribution over ingot with sample a few kelvins below or above melting temperature		1.5 K, below	

Table II.2.4. Details of participant's Sn cells and their respective furnaces, etc.

	NIST	NML	PTB	VNIIM	BNM-INM	SMU
Cell commercial/Lab made	lab made	lab made	lab made	lab made	lab made	commercial
Crucible material (graphite, etc.)	graphite	graphite	graphite	graphite	graphite	graphite
Source	ULTRA CARBON	After manufacture		Russia	Carbone Lorraine	Carbone of America
Purity/how purified	<5 ppm, F	After manufacture		99.9999%	99.9995%	99.9997%
Length / cm	24.4	21.0	22	26.0	21.0	28.2
Diameter / mm	43	45	48	36	34	48
Thermometer well material	graphite & SiO2	Pyrex	graphite	graphite	silica	graphite & quartz
Thermometer well ID / mm	8	8	8	12	7.5	8
Metal sample source	Johnson Matthey, Spokane	Johnson Matthey, Spokane		Russia	Braconnot	Johnson Matthey
Metal sample purity	99.999998%	99.9999%	99.9999%	99.9999%	99.999 95%	99.9999%
Metal sample weight / kg	1.07	1.100	0.780	1.116	0.823	0.96
Crucible container material	borosilicate	Pyrex		quartz	silica	quartz
Open or closed cell	open	open	open	open	closed	sealed
Pressure in cell / kPa	101.325	101.325		101.325 ± 0.100	101.325	80.288
Immersion depth of SPRT / cm	18		17.5	19.0	17.0	17.5/17.0
Crucible container OD / mm	50	51	48	52	49	54
Furnace details						
Furnace or bath?	Furnace	Furnace	furnace	furnace	Furnace	furnace
Commercial/Lab made	Lab made	Lab	commercial	Lab made	Lab made	commercial
DC or AC heater power	dc	ac	ac	ac	ac	AC
Furnace control type	Automatic	Variac	Eurotherm	Lab made	PID	PI
Furnace controlled by temperature sensor or by power settings	temperature sensor	Power	controller	temperature sensor	sensor	temperature sensor
Temperature stability over 16 hrs. (mK)	±6		< 0.1 °C	50	100	
How many zones in furnace	3	3	3	three zones	1	3
Heat pipe liner/working material	aluminum core	n/a	-	-	air flow furnace	
Uniformity in furnace (without cell)				-		<0.1K
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	5 mK	<0.01 °C/cm	8 mK	10 mK	< 100 mK	0.02 K

Table II.2.4. Details of participant's Sn cells and their respective furnaces, etc. (continued).

	NPL	**BIPM**	**NRC**	**NMi/VSL**	**IMGC**	**MSL**
Cell commercial/Lab made	lab made	no cells	lab made	lab made	lab made	commercial
Crucible material (graphite, etc.)	Graphite		graphite	graphite	graphite	graphite
Source	Ringsdorf		Ultra Carbon	Cominco	ULTRA CARBON	unknown
Purity/how purified	Baked		10 ppm	99.9999%	< 5 ppm	unknown
Length / cm	23.4		30	49.0	23.5	20
Diameter / mm	43		45	50	44	43
Thermometer well material	silica		graphite	graphite out, duran in	silica	quartz + graphite
Thermometer well ID / mm	9		11	7.9	10.8	9
Metal sample source	Johnson Matthey		Vulcan	Cominco	Cominco	Leico
Metal sample purity	99.9999%		99.9999%	99.9999%	99.9999%	0.5 mg/Kg
Metal sample weight / kg	0.680		1.183	1.057	NIST value	not known
Crucible container material	pyrex		quartz	duran glass	pyrex	quartz
Open or closed cell	open		open	open	open	open
Pressure in cell / kPa	101		101.325	101.3+10.1	101.325	101.325
Immersion depth of SPRT / cm	17.4		21.5	20.0	18	13.5 to ctr. of sensor
Crucible container OD / mm	50		50	44	50	47
Furnace details						
Furnace or bath?	Furnace		furnace	furnace	Furnace	furnace
Commercial/Lab made	Comm.		lab	lab	Lab made	commercial
DC or AC heater power	ac		dc	dc	ac	ac
Furnace control type	Thyristor		PID	Eurotherm	Automatic	PID 0-xing
Furnace controlled by temperature sensor or by power settings	sensor		sensor	N-type TC	temperature sensor	temperature
Temperature stability over 16 hrs. (mK)	50		100	50	50	200
How many zones in furnace	3		1	3	1	1
Heat pipe liner/working material			n/a	-	Heat pipe liner	none
Uniformity in furnace (without cell)	0.2 °C		< 100 mK			not measured
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	not measured		< 100 mK	< 100 mK	within stability	not measured

Table II.2.4. Details of participant's Sn cells and their respective furnaces, etc. (continued).

	NRLM	NIM	KRISS
Cell commercial/Lab made	Com.	lab made	lab made
Crucible material (graphite, etc.)	graphite	graphite	graphite
Source		NIM	Ultra carbon
Purity/how purified		99.995%	99.999%/B.V.
Length / cm	23.0	24.5	25.5
Diameter / mm	57	41	44
Thermometer well material	quartz	quartz	graphite
Thermometer well ID / mm	8	8	11
Metal sample source		China	Johnson Matthey
Metal sample purity	99.9999%	99.9999%	99.9999%
Metal sample weight / kg	0.494	0.800	1.0
Crucible container material	Pyrex		Silica glass
Open or closed cell	open	open	open
Pressure in cell / kPa	101.3±1.0	101.325	
Immersion depth of SPRT / cm	17.0	17.0	14.0
Crucible container OD / mm	64	49	51
Furnace details			
Furnace or bath?	Furnace	Furnace	F
Commercial/Lab made	commercial	Lab made	commercial
DC or AC heater power	ac	ac	ac
Furnace control type	PID	Automatic	PID
Furnace controlled by temperature sensor or by power settings	sensor	temperature sensor	temperature sensor
Temperature stability over 16 hrs. (mK)	50, pk-pk	10	10
How many zones in furnace	3	3	3
Heat pipe liner/working material			
Uniformity in furnace (without cell)		< 0.2 K	50 mK
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	20 mK, pk-pk	1.5 K, below	5 mK

Table II.2.5. Details of participant's In cells and their respective furnaces, baths, etc.

	NIST	NML	PTB	VNIIM	BNM-INM	SMU
Cell commercial/Lab made	lab made	lab made	commercial	lab made	lab made	no cells
Crucible material (graphite, etc.)	graphite	graphite	graphite	Teflon	graphite	
Source	ULTRA CARBON	Ultracarbon	Isotech	Russia	Carbone Lorraine	
Purity/how purified	<5 ppm, F	After manufacture		99.9999%	99.9995%	
Length / cm	24.4	21.0	22	26.5	21.0	
Diameter / mm	43	45	42	43	34	
Thermometer well material	graphite	Pyrex	graphite/quartz	Teflon	silica	
Thermometer well ID / mm	8	8	8	8	7.5	
Metal sample source	Arconium	Johnson Matthey (Spokane)		Russia	Johnson Matthey	
Metal sample purity	99.999 99%	99.9999%	99.9999%	99.9999%	99.9999%	
Metal sample weight / kg	1.08	0.990		0.850	0.820	
Crucible container material	borosilicate	Pyrex	quartz	-	silica	
Open or closed cell	open	open	open	open	closed	
Pressure in cell / kPa	101.325	101.325		101.325± 0.100	101.325	
Immersion depth of SPRT / cm	18		18.5	18.2	17.0	
Crucible container OD / mm	50	51	48	43	49	
Furnace details						
Furnace or bath?	Furnace	Furnace	furnace	furnace	Furnace	
Commercial/Lab made	Lab made	Lab	commercial	Lab made	Lab made	
DC or AC heater power	dc	ac	ac	ac	ac	
Furnace control type	Automatic	Variac	Eurotherm	Lab made	PID	
Furnace controlled by temperature sensor or by power settings	temperature sensor	Power	controller	temperature sensor	sensor	
Temperature stability over 16 hrs./mK	±4		< 100	20	100	
How many zones in furnace	3	3	3	3	1	
Heat pipe liner/working material	aluminum core	n/a	-	-	air flow furnace	
Uniformity in furnace (without cell)				-	< 0.1 °C	
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	5 mK	< 10 mK/cm	8 mK	5 mK	< 100 mK	

Table II.2.5. Details of participant's In cells and their respective furnaces, baths, etc. (continued).

	NPL	BIPM	NRC	NMi/VSL	IMGC	MSL
Cell commercial/Lab made	lab made	no cells	lab made	lab made	lab made	commercial
Crucible material (graphite, etc.)	Graphite		graphite	graphite	graphite	graphite
Source	Ringsdorf		Ultra Carbon	Preussag pure metals	ULTRA CARBON	unknown
Purity/how purified	Baked		10 ppm	99.999 99%	< 5 ppm	unknown
Length / cm	23.4		30	49.0	21.5	20
Diameter / mm	43		45	50	44	43
Thermometer well material	silica		graphite	graphite out, duran in	silica	quartz + graphite
Thermometer well ID / mm	9		11	7.9	10.8	9
Metal sample source	Johnson Matthey		Arconium	Preussag pure metals	Cominco	Leico
Metal sample purity	99.9999%		99.999 99%	99.999 99%	99.9999%	0.5 mg/Kg
Metal sample weight / kg	0.684		1.393	1.063	1.03	not known
Crucible container material	pyrex		quartz	duran glass	pyrex	quartz
Open or closed cell	open		open	open	open	open
Pressure in cell / kPa	101		101.325	101.3+10.1	101.325	101.325
Immersion depth of SPRT / cm	17.4		21	18.5	16	13.5 to ctr. of sensor
Crucible container OD / mm	50		50	44	50	47
Furnace details						
Furnace or bath?	Furnace		furnace	furnace	Furnace	furnace
Commercial/Lab made	commercial		lab	lab made	lab made	commercial
DC or AC heater power	ac		dc	dc	ac	ac
Furnace control type	Thyristor		PID	Eurotherm	Automatic	PID 0-xing
Furnace controlled by temperature sensor or by power settings	sensor		sensor	N-type TC	temperature sensor	temperature
Temperature stability over 16 hrs./mK	50		100	50	50	200
How many zones in furnace	3		1	3	1	1
Heat pipe liner/working material			n/a	-	Heat pipe liner	none
Uniformity in furnace (without cell)	0.2 °C		< 100 mK			not measured
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	not measured		< 100 mK	< 100 mK	within stability	not measured

Table II.2.5. Details of participant's In cells and their respective furnaces, baths, etc. (continued).

	NRLM	NIM	KRISS
Cell commercial/Lab made	Commercial	lab made	lab made
Crucible material (graphite, etc.)	graphite	graphite	Pyrex glass
Source		NIM	
Purity/how purified		99.995%	cleaning
Length / cm		24.5	18.0
Diameter / mm		41	35
Thermometer well material	Quartz		Pyrex glass
Thermometer well ID / mm	8	closed	10
Metal sample source		China	Johnson Matthey
Metal sample purity		99.9999%	99.9999%
Metal sample weight / kg		0.800	0.7
Crucible container material			Pyrex glass
Open or closed cell	open	closed	sealed
Pressure in cell / kPa		101.325	101.325
Immersion depth of SPRT / cm		17	11.5
Crucible container OD / mm		49	
Furnace details			
Furnace or bath?	Furnace	Furnace	Furnace
Commercial/Lab made	commercial	lab made	commercial
DC or AC heater power	ac	ac	ac
Furnace control type	PID	Automatic	PID
Furnace controlled by temperature sensor or by power settings	sensor	temperature sensor	temperature sensor
Temperature stability over 16 hrs./mK		10	10
How many zones in furnace	3	3	3
Heat pipe liner/working material			
Uniformity in furnace (without cell)		< 0.2 K	50
Temperature distribution over ingot with sample a few kelvins below or above melting temperature		1.5 K, below	5

Table II.2.6. Details of participant's Ga cells and their respective furnaces, baths, etc.

	NIST	NML	PTB	VNIIM	BNM-INM	SMU
Cell commercial/Lab made	lab made	commercial	commercial	lab made	lab made	lab made
Crucible material (graphite, etc.)	virgin PTFE	Teflon/nylon	Teflon	Teflon	Teflon	PTFE
Source	commercial	YSI	Isotech	Russia	Weber	Mikrotech
Purity/how purified		?		99.9999%	chemically	
Length / cm	24		32 cm	19.0	18.2	25.1
Diameter / mm	39			36	31	40
Thermometer well material	PTFE	s/s-nylon	Teflon	Teflon	Nylon	PTFE
Thermometer well ID / mm	8		12	8	8.6	8.5
Metal sample source	Rhone-Poulenc	?		Russia	Alussuisse	CMK Slovakia
Metal sample purity	99.999 995%	?		99.9999%	99.9999%	99.999 99%
Metal sample weight / kg	1.0	?		0.660	0.660	0.93
Crucible container material	borosilicate	pyrex		-	Nylon	
Open or closed cell	open	open	open	open	closed	open
Pressure in cell / kPa	vapor pressure	101.325		101.325±0.100	101.325	
Immersion depth of SPRT / cm	18		28.5	12.5	16.5	17.5/17.0
Crucible container OD / mm	51		37	36	50	
Furnace details						
Furnace or bath?	Furnace	Water bath	calibrator	furnace	furnace	bath
Commercial/Lab made	lab made	lab made	commercial	lab made	lab made	commercial
dc or ac heater power	dc		dc	ac	ac	ac
Furnace control type	Automatic	electronic		Lab made	PID	PI
Furnace controlled by temperature sensor or by power settings	temperature sensor	PRT		temperature sensor	sensor	temperature sensor
Temperature stability over 16 hrs./mK	±10			10	100	< 1
How many zones in furnace	1		1	3	1	
Heat pipe liner/working material	aluminum core w/ mineral oil	n/a	-	-	air flow furnace	
Uniformity in furnace (without cell)		1 mK		-	< 100 mK over crucible length	1 mK
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	7 mK	1 mk		5 mK	< 100 mK	

Table II.2.6. Details of participant's Ga cells and their respective furnaces, baths, etc. (continued).

	NPL	BIPM	NRC	NMi/VSL	IMGC	MSL
Cell commercial/Lab made	lab made	commercial (Pyro-Controle)	lab made	commercial	lab made	commercial
Crucible material (graphite, etc.)	PTFE	Teflon	Teflon	Teflon	PTFE	PTFE
Source	unknown	unknown	unknown	YSI		unknown
Purity/how purified	acid + water		acid + water	99.9999%		unknown
Length / cm	19.0	23	20	30.0	17	30
Diameter / mm	38	35	37	approx. 32	28	38
Thermometer well material	PTFE	Teflon	Nylon	Teflon	SS/Cu	PTFE
Thermometer well ID / mm	9	9	11	12 to 13	9	12
Metal sample source	Cominco		Johnson Matthey	YSI	Alusuisse	unknown
Metal sample purity	99.9999%	99.9999%	99.999 99%	99.9999%	99.999 99%	0.5 mg/Kg
Metal sample weight / kg	0.763		1.400	0.400	0.50	unknown
Crucible container material	PTFE	Teflon	quartz	aluminum and Teflon	Pyrex	aluminum and PTFE
Open or closed cell	open	closed	open	closed	open	open
Pressure in cell / kPa	101	101.325	101.325	101.325	vp or 101.325	101.3
Immersion depth of SPRT / cm	17.0	14.2	14	28.0	12	20.5 to ctr. of sensor
Crucible container OD / mm	38	50	50	38	50	28
Furnace details						
Furnace or bath?	Bath	furnace, pulsed air	furnace	oven	heater on metal block	oven
Commercial/Lab made	commercial	commercial	lab made	commercial, YSI	lab made	commercial
dc or ac heater power	ac		dc	pulsed dc	dc	NA
Furnace control type	Thyristor		PID	YSI	Automatic	electronic
Furnace controlled by temperature sensor or by power settings	sensor		sensor	NTC	temperature sensor	temperature
Temperature stability over 16 hrs./mK	100	50	100	10	± 50	not measured
How many zones in furnace	1	1	1	1	1	1
Heat pipe liner/working material		Pulsed air	n/a	-	Copper block	none
Uniformity in furnace (without cell)	100 mK		< 100 mK			not measured
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	not measured		< 100 mK	?	within stability	not measured

Table II.2.6. Details of participant's Ga cells and their respective furnaces, baths, etc. (continued).

	NRLM	NIM	KRISS
Cell commercial/Lab made	lab made	lab made	lab made
Crucible material (graphite, etc.)	Teflon	Teflon	Teflon
Source		NIM	
Purity/how purified			cleaning
Length / cm		21.0	31.0
Diameter / mm		41	50
Thermometer well material		glass	Teflon
Thermometer well ID / mm		8	12
Metal sample source		China	Johnson Matthey
Metal sample purity		99.9999%	99.999 99%
Metal sample weight / kg		0.45	0.8
Crucible container material			Pyrex glass
Open or closed cell		closed	open
Pressure in cell / kPa		101.325	
Immersion depth of SPRT / cm		14.0	18.0
Crucible container OD / mm		39	
Furnace details			
Furnace or bath?	bath	Furnace	bath
Commercial/Lab made		lab made	commercial
dc or ac heater power		dc	ac
Furnace control type		Automatic	P
Furnace controlled by temperature sensor or by power settings		temperature sensor	temperature sensor
Temperature stability over 16 hrs./mK		10	5
How many zones in furnace		1	
Heat pipe liner/working material			
Uniformity in furnace (without cell)		< 0.2 K	10 mK
Temperature distribution over ingot with sample a few kelvins below or above melting temperature		1 K, above	2 mK

Table II.2.7. Details of participant's TPW cells and their respective baths, etc.

	NIST	**NML**	**PTB**	**VNIIM**	**BNM-INM**	**SMU**
Manufacturer	Jarrett	Jarrett	Forschungsgemeinschaft techn. Glas, Wertheim, Germany	Lab made	NPL	SMU made, Model TBV
Well diameter / mm	13	11 mm	12	8	12	10
Water source and purity?	multiple distilled tap water	Conductivity ~ 4 x best water	The cell has been compared to those of some other NMIs.	double distillation in quartz apparatus	?	local water source, conductivity of water (after preparation) at time of filling less than 40 µsiemens per meter (corresponds to 0.02 mK).
Immersion depth of SPRT in the cell / cm	26.5	26.0	21.5 cm total	19.0	26	24.0 cm for Hart, 23.5 cm for Rosemount
Heat transfer fluid?	distilled tap water	water	water	water	Water	water
Heat transfer fluid level in thermometer well (cm)	full, 32 cm	to mantle top	21.5	16.0	free level of the water in the cell (23 cm)	equal with the top of ice mantle
Use of metal bushing?	yes, Al bushing	no	no	no	no	no
How are mantles prepared?	immersion cooler	dry ice/freon heatpipe	immersion cooler	Solid CO_2	metal rod cooled with liquid nitrogen	crushed solid CO_2
How long are mantles prepared before use?	10 days	>24 hours	36 h	4 days	more than 20 hours	minimum of 7 days
How are mantles maintained - ice or stirred bath	stirred liquid bath	distilled water ice	stirred bath	ice	stirred bath	stirred bath

Table II.2.7. Details of participant's TPW cells and their respective baths, etc. (continued).

	NPL	BIPM	NRC	NMi/VSL	IMGC	MSL
Manufacturer	NPL	PTB & KRISS	Jarrett/ Isotech	NMi	IMGC	MSL
Well diameter / mm	12	13 and 12	11	10	10	9
Water source and purity?	triple distilled tap water		distilled tap water	filtered, demineralised and doubly distilled.	triply distilled tap water	local tap, double distilled and degassed
Immersion depth of SPRT in the cell / cm	19.0	25	23	> 20.0 cm, dependent on cell.	22.5	25.0
Heat transfer fluid?	water	distilled water	water	yes	deionized water	water
Heat transfer fluid level in thermometer well (cm)	20.0	27	15	water	38	24
Use of metal bushing?	no	no	no	no	no	no
How are mantles prepared?	solid CO_2	dry ice	dry ice	freezing with special through-flow liquid-nitrogen tubes.	brass rod precooled in LN_2 with alcohol in the well	liquid N_2 boil-off
How long are mantles prepared before use?	7 days (for this comparison)	at least 3 days	1 week	at least 24 hours.	5 days	>3 days
How are mantles maintained - ice or stirred bath	ice	ice, up to 3 months	ice	stirred bath, maintained for several months.	in plexiglass container in ice bath	ice

Table II.2.7. Details of participant's TPW cells and their respective baths, etc. (continued).

	NRLM	**NIM**	**KRISS**
Manufacturer	commercial	NIM	commercial
Well diameter / mm	11	8	13
Water source and purity?	not evaluated	NIM specific conductance (5-1) x 10^{-6} $cm^{-1}Ohm^{-1}$	unknown
Immersion depth of SPRT in the cell / cm	27.5	24	26.1
Heat transfer fluid?	water	water	water 90% + ethanol 10%
Heat transfer fluid level in thermometer well (cm)	same as the cell inside water level with SPRT present	24	30.0
Use of metal bushing?	Copper bushing	no	Al bushing
How are mantles prepared?	liq N_2 cooled nitrogen gas	liquid N_2	Dry Ice powder
How long are mantles prepared before use?	3 days	more than 72 hours	2 months
How are mantles maintained - ice or stirred bath	stirred bath	ice	stirred bath

Table II.2.8. Details of participant's Hg cells and their respective cryostats, baths, etc.

	NIST	NML	PTB	VNIIM	BNM-INM	SMU
Cell commercial/Lab made	lab made	lab made	commercial	no cells	lab made	no cells
Crucible material (graphite, etc.)	stainless steel	s/s 316L	high grade steel		SS	
Source	commercial	Whitey	Isotech			
Purity/how purified					,(2)	
Length / cm	24		47		19.0	
Diameter / mm	38	50	39.2		28	
Thermometer well material	stainless steel	s/s 316L	high grade steel		SS	
Thermometer well ID / mm	8	7	8		8	
Metal sample source	NIST purified	in house			Rhones Alpes mercure	
Metal sample purity	99.999 999 %	< 99.9999 %	99.999 998 %		99.9999%	
Metal sample weight / kg	2.3	?	3.00		1.200	
Crucible container material	stainless steel	s/s			SS	
Open or closed cell	closed	t/p	closed		closed	
Pressure in cell / kPa	vapor pressure	t/p				
Immersion depth of SPRT / cm	15		19		18.0	
Crucible container OD / mm	51		39.2			
Cryostat details						
Cryostat or bath?	Bath (with ethanol)	Alcohol Bath	calibrator		bath	
Commercial/Lab made	Commercial	lab	commercial		Lab made	
DC or AC heater power	ac				ac	
Cryostat control type	Automatic	electronic	electronic		PID	
Cryostat controlled by temperature sensor or by power settings	by temperature sensor	by PRT			sensor	
Temperature stability over 16 hrs./mK	±2		< 100		50	
How many zones in cryostat					1	
Heat pipe liner/working material		n/a			alcohol bath	
Uniformity in cryostat (without cell)		1 mK			<0.05 °C	
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	4 mK	1mK			<0.05 °C	

Table II.2.8. Details of participant's Hg cells and their respective cryostats, baths, etc. (continued).

	NPL	BIPM	NRC	NMi/VSL	IMGC	MSL
Cell commercial/Lab made	lab made		lab made	lab made	Commercial	Commercial
Crucible material (graphite, etc.)	AISI 304 SS		glass	glass out, SS/copper in	SS	steel
Source	unknown		unknown	Cominco	commercial	unknown
Purity/how purified			Acid+water + steam	99.999 99%		unknown
Length / cm	19.5		23.5	25.0	21	23.5
Diameter / mm	35		38	42	40	38
Thermometer well material	steel		glass	glass out, SS/copper in	SS	steel
Thermometer well ID / mm	10		8	12.5	8	8
Metal sample source	Johnson Matthey		Johnson Matthey	Cominco	commercial	unknown
Metal sample purity	99.999 995%		99.999 995%	99.999 99%	99.9999%	20 µg/Kg
Metal sample weight / kg	2.430		2.500	2.300	3	unknown
Crucible container material	pyrex		glass	stainless steel	pyrex	steel
Open or closed cell	sealed		closed	closed	sealed	closed
Pressure in cell / kPa	0		Hg vapour	triple point	vapor pressure	triple point
Immersion depth of SPRT / cm	16.5		17.5	18.7	15	15.5 to ctr. of sensor
Crucible container OD / mm	45		63	38	50	39
Cryostat details				contains copper tube as bushing		
Cryostat or bath?	bath		bath	bath	Heat exchanger	cryostat
Commercial/Lab made	Lab made		lab	com. ISOT	lab made	commercial
DC or AC heater power	ac		dc	ac		NA
Cryostat control type	Thyristor		PID	Eurotherm		electronic
Cryostat controlled by temperature sensor or by power settings	sensor		sensor	Pt100		temperature
Temperature stability over 16 hrs./mK	100		100	40	±0,05	<100
How many zones in cryostat	1		1	N/A.	1	1
Heat pipe liner/working material			n/a	alcohol		none
Uniformity in cryostat (without cell)	0.1 °C		<0.1 °C			not measured
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	-		<0.1 °C	< 20 mK	within stability	not measured

Table II.2.8. Details of participant's Hg cells and their respective cryostats, baths, etc. (continued).

	NRLM	NIM	KRISS
Cell commercial/Lab made	Commercial	lab made	Commercial
Crucible material (graphite, etc.)	none		Stainless steel
Source		NIM	
Purity/how purified			-
Length / cm		45.0	23.0
Diameter / mm		41	39
Thermometer well material	SUS		Stainless steel
Thermometer well ID / mm	8	8	9.5
Metal sample source		China	unknown
Metal sample purity		99.9999%	unknown
Metal sample weight / kg		2.4	3.0
Crucible container material	SUS		Stainless steel
Open or closed cell	sealed	closed	sealed
Pressure in cell / kPa			101.3
Immersion depth of SPRT / cm		> 20.0	15.5
Crucible container OD / mm			
Cryostat details			
Cryostat or bath?	bath	bath	refrigerator
Commercial/Lab made	lab made	lab made	commercial
DC or AC heater power	ac	ac	ac
Cryostat control type	zero cross	Automatic	P
Cryostat controlled by temperature sensor or by power settings	sensor	temperature sensor	sensor
Temperature stability over 16 hrs./mK	5	10	10
How many zones in cryostat		1	
Heat pipe liner/working material			
Uniformity in cryostat (without cell)		5 mK	10 mK
Temperature distribution over ingot with sample a few kelvins below or above melting temperature	10 mK	2 K, above	5 mK

Table II.2.9. Details of participant's Ar cells and their respective cryostats, etc.

	NIST	NML	PTB	VNIIM	BNM-INM	SMU
Cell commercial/Lab made	lab made		commercial		lab made	no cells
Crucible material (graphite, etc.)	OFHC Cu		high grade steel		SS	
Source			BNM-INM/CNAM			
Purity/how purified	chemically cleaned				chemically cleaned	
Length / cm	15.24		30		(18.0+12.0)	
Diameter / mm	79.4		100/30 mm		(100/30)	
Thermometer well material	SS-SPRTs, Cu-CSPRTs		high grade steel		SS	
Thermometer well ID / mm	(6 @ 8.1; 1 @ 11.3)-SPRTs; (6 @ X 5.4)-CSPRTs		8		8	
Sample source	Airco		Air Liquide		Air Liquide gas	
Sample purity	> 99.9999%		99.9998%		99.9999%	
Sample weight / kg or moles	15.6 moles condensed		60 bar / 5 moles		0.105	
Crucible container material	OFHC Cu		high grade steel		SS	
Open or closed cell	closed		closed		closed	
Pressure in cell / kPa	vapor pressure					
Immersion depth of SPRT / cm	10.9		30/12		12.0 (in liquid)	
Crucible container OD / mm					(100/30)	
Cryostat details						
Cryocooler or bath?	Liquid N_2 bath		Liquid N_2 bath		Liquid N_2 bath	
Commercial/Lab made	commercial / lab made		lab made		lab made	
dc or ac heater power	dc					
Cryostat control type	automatic, electronic		pressure control			
Cryostat controlled by temperature sensor or by power settings	temperature sensor		pressure control			
Temperature stability over 16 hrs./mK	±1		< 50 mK (8 h)			
Number of shields for cryostat	1 active, 1 passive					
Uniformity in cryostat					<200 mK	
Temperature distribution over sample cell with cell a few kelvins below or above melting temperature	2 mK					

Table II.2.9. Details of participant's Ar cells and their respective cryostats, etc. (continued).

	NPL	BIPM	NRC	NMi/VSL	IMGC	MSL
Cell commercial/Lab made	lab made		lab made			
Crucible material (graphite, etc.)	AISI 316 or 321 SS		Copper			
Source			Unknown			
Purity/how purified			Chemically cleaned			
Length / cm	20		9			
Diameter / mm	18		32			
Thermometer well material			Copper, thin-walled s.s.			
Thermometer well ID / mm	8		7.4			
Sample source	Air Liquide					
Sample purity	99.9999%		99.9995%			
Sample weight / kg or moles	0.03 mol		0.05 mol			
Crucible container material	foam plastic		Cu			
Open or closed cell	closed		Closed			
Pressure in cell / kPa	vapor pressure		2500 kPa at 20 °C			
Immersion depth of SPRT / cm	7.5					
Crucible container OD / mm	96					
Cryostat details						
Cryocooler or bath?	liquid N_2		liquid N_2			
Commercial/Lab made	lab made		Lab made			
dc or ac heater power	ac		Dc			
Cryostat control type	manostat		PID on shields			
Cryostat controlled by temperature sensor or by power settings	pressure		Temperature sensor			
Temperature stability over 16 hrs./mK	<100		1 mK			
Number of shields for cryostat			2 active shields			
Uniformity in cryostat	not measured					
Temperature distribution over sample cell with cell a few kelvins below or above melting temperature						

Table II.2.9. Details of participant's Ar cells and their respective cryostats, etc. (continued).

	NRLM	NIM	KRISS
Cell commercial/Lab made			
Crucible material (graphite, etc.)			
Source			
Purity/how purified			
Length / cm			
Diameter / mm			
Thermometer well material			
Thermometer well ID / mm			
Sample source			
Sample purity			
Sample weight / kg or moles			
Crucible container material			
Open or closed cell			
Pressure in cell / kPa			
Immersion depth of SPRT / cm			
Crucible container OD / mm			
Cryostat details			
Cryocooler or bath?			
Commercial/Lab made			
dc or ac heater power			
Cryostat control type			
Cryostat controlled by temperature sensor or by power settings			
Temperature stability over 16 hrs./mK			
Number of shields for cryostat			
Uniformity in cryostat			
Temperature distribution over sample cell with cell a few kelvins below or above melting temperature			

Table II.3.1. Details on participant's techniques of realization of the freezing-point temperature of Al.

	NIST	NML	PTB		VNIIM	BNM-INM
Procedure (freeze or melt)	freeze	freeze	HN cells freeze	freeze	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight	> 4 h	> 10 h	> 10 h	14 h	overnight
Method of nucleation freeze or melt	induced	Self	TFP - 0.6 K	TFP - 1 K	lowering furnace temperature	
Method of forming inner liquid/solid interface	chilling	induced	induced	induced	induced	induced
If by chilling, give method (glass rods, gas, etc.)	glass rod	2x rod 1 min	cool rod 2x1 min.	cool rod 1 min.	two quartz rods	glass+metal
If by heating, give method (glass rods, heater, etc.)						
Fluid used in thermometer well for thermal contact	air	air	air	air	air	air
Liquid fluid level in thermometer well / cm						
Use of bushing with REC SPRT?	yes	yes	no	no	yes	yes
If yes, specify the material	Inconel	quartz tube			Inconel	Pt
Duration of freeze or melt / h	>16	~ 3	10	4	10	6
Was cell used for freezing point? Melting point? Triple point?	FP	FP	FP	FP	FP	FP

Table II.3.1. Details on participant's techniques of realization of the freezing-point temperature of Al. (cont.)

SPRT heat treatment	**NIST**	**NML**	**PTB**	**PTB**	**VNIIM**	**BNM-INM**
Was SPRT heated to about 675 °C in pre-heat furnace before being transferred to Al freezing-point cell?	yes	yes	yes	yes	yes	yes
If yes, how many hours to reach 675 °C?	1	~4		4 h	2 h	immediately
After Al freezing point measurement, was SPRT transferred directly to annealing furnace at approximately 675 °C and then cooled over several hours to 500 °C before removing to room temperature?	yes	yes	yes, 675 °C	yes, 670 °C	yes	yes
If yes, how many hours?	3.5	~4	3 to 4	2	4	4
If no, how was SPRT heat treated?						

Table II.3.1. Details on participant's techniques of realization of the freezing-point temperature of Al. (cont.)

	SMU	NPL	BIPM	NRC	NMi/VSL
Procedure (freeze or melt)	freeze	freeze	no cells	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	14 h	~6 h		overnight	typically 12 hours
Method of nucleation freeze or melt	Furnace temp. 1 °C below FP until recalescence, then 3 silica-glass rods for 1 min each, then furnace temp. 0.5 °C below FP			in furnace	T(TP) -4 K
Method of forming inner liquid/solid interface	induced	induced		chilling	induced
If by chilling, give method (glass rods, gas, etc.)	silica-glass rod	rod		rod	quartz rod
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air	air		air	air
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?	no	no		no	no
If yes, specify the material					
Duration of freeze or melt / h	9.5, minimum	6		>10	6
Was cell used for freezing point? Melting point? Triple point?	FP	FP		FP	FP

Table II.3.1. Details on participant's techniques of realization of the freezing-point temperature of Al. (cont.)

SPRT heat treatment	**SMU**	**NPL**	**BIPM**	**NRC**	**NMi/VSL**
Was SPRT heated to about 675 °C in pre-heat furnace before being transferred to Al freezing-point cell?	yes	yes		yes	yes
If yes, how many hours to reach 675 °C?	1 h	45 min		1 hour	45 minutes from 500 °C to 675 °C
After Al freezing point measurement, was SPRT transferred directly to annealing furnace at approximately 675 °C and then cooled over several hours to 500 °C before removing to room temperature?	maintain at 675 °C for 0.5 h, then decrease to 500 °C over 4 h	yes		No	yes, cooling at 1 °C/min down to 450 °C
If yes, how many hours?	4	3.5			3.75
If no, how was SPRT heat treated?				SPRT placed in 3-zone furnace at 480 °C and annealed for approximately 16 hrs.	

Table II.3.1. Details on participant's techniques of realization of the freezing-point temperature of Al. (cont.)

	IMGC	MSL	NRLM	NIM	KRISS
Procedure (freeze or melt)	freeze	no cells	no data provided	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight			overnight	2
Method of nucleation freeze or melt	induced				slow freeze
Method of forming inner liquid/solid interface	induced			induced	induced
If by chilling, give method (glass rods, gas, etc.)	silica tube with alumina			glass rods	glass rods
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air			air	air
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?	no			no	yes
If yes, specify the material					Inconel
Duration of freeze or melt / h	40			8	6
Was cell used for freezing point? Melting point? Triple point?	FP			FP	FP

Table II.3.1. Details on participant's techniques of realization of the freezing-point temperature of Al. (cont.)

SPRT heat treatment	**IMGC**	**MSL**	**NRLM**	**NIM**	**KRISS**
Was SPRT heated to about 675 °C in pre-heat furnace before being transferred to Al freezing-point cell?	yes			yes	yes
If yes, how many hours to reach 675 °C?	1			60 min from 500 °C	3
After Al freezing point measurement, was SPRT transferred directly to annealing furnace at approximately 675 °C and then cooled over several hours to 500 °C before removing to room temperature?	yes			yes but to < 450 °C	yes
If yes, how many hours?	4			4	3
If no, how was SPRT heat treated?					

Table II.3.2. Details on participant's techniques of realization of the freezing-point temperature of Zn.

	NIST	NML	PTB	VNIIM	BNM-INM
Procedure (freeze or melt)	freeze	freeze	freeze	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight	> 4 h	> 10 h	14 h	overnight
Method of nucleation freeze or melt	induced	Self	TFP - 1K	lowering furnace temperature	
Method of forming inner liquid/solid interface	chilling	induced	induced	induced	induced
If by chilling, give method (glass rods, gas, etc.)	glass rods	2x rod 1 min	thermom. 1 min in air, cool rod 1 min	two quartz rods	glass
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air	air	air	air	air
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?	yes	yes	no	yes	yes
If yes, specify the material	Al	quartz tube		Al	Pt
Duration of freeze or melt / h	>16	~ 3	8	10	15
Was cell used for freezing point? Melting point? Triple point?	FP	FP	FP	FP	FP

Table II.3.2. Details on participant's techniques of realization of the freezing-point temperature of Zn. (cont.)

	SMU	NPL	BIPM	NRC	NMi/VSL
Procedure (freeze or melt)	freeze	freeze	no cells	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	14 h	~6 h		overnight	typically 12 hours
Method of nucleation freeze or melt	Furnace temp. 1 °C below FP until recalescence, then 3 silica-glass rods for 1 min each, then furnace temp. 0.5 °C below FP			in furnace	T(TP) -0.2 K
Method of forming inner liquid/solid interface	induced	induced		chilling	induced
If by chilling, give method (glass rods, gas, etc.)	silica-glass rod	rod		rod	quartz
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air	air		air	air
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?	no	yes		no	no
If yes, specify the material		Al			
Duration of freeze or melt / h	12	12		>10	>10
Was cell used for freezing point? Melting point? Triple point?	FP	FP		FP	FP

Table II.3.2. Details on participant's techniques of realization of the freezing-point temperature of Zn. (cont.)

	IMGC	MSL	NRLM	NIM	KRISS
Procedure (freeze or melt)	freeze	freeze	freeze	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight	overnight	>5 h	overnight	2
Method of nucleation freeze or melt	induced	slow freeze	freeze	-	slow freeze
Method of forming inner liquid/solid interface	induced	chilling	induced	induced	induced
If by chilling, give method (glass rods, gas, etc.)	PRT	glass rods	glass rod	glass rods	stainless steel
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air	air	air	air	air
Liquid fluid level in thermometer well / cm		NA			
Use of bushing with REC SPRT?	no	no	no	no	yes
If yes, specify the material					Inconel
Duration of freeze or melt / h	75	10	>10	5	13
Was cell used for freezing point? Melting point? Triple point?	FP	FP	FP	FP	FP

Table II.3.3. Details on participant's techniques of realization of the freezing-point temperature of Cd.

	NIST	NML	PTB	VNIIM	BNM-INM
Procedure (freeze or melt)	freeze	freeze	freeze	freeze	no cells
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight	>4 hours	> 10 h	14 hours	
Method of nucleation freeze or melt	induced	Self	T_{FP} - 1 K	lowering furnace temperature	
Method of forming inner liquid/solid interface	chilling	chill	chilling	induced	
If by chilling, give method (glass rods, gas, etc.)	glass rods	2x rod 1 min	thermom. 2 min in air, cool rod 1 min	two quartz rods	
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air	air	air		
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?	yes	yes	no	yes	
If yes, specify the material	Al	quartz tube		Al	
Duration of freeze or melt / h	>16	~ 3 hours		11	
Was cell used for freezing point? Melting point? Triple point?	FP	FP	FP	FP	

Table II.3.3. Details on participant's techniques of realization of the freezing-point temperature of Cd. (cont.)

	SMU	NPL	BIPM	NRC	NMi/VSL
Procedure (freeze or melt)	freeze (NIST's cell)	freeze	no cells	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	14 hours	~6 h		overnight	typically 12 hours
Method of nucleation freeze or melt	Furnace temp. 1 °C below FP until recalescence, then silica-glass rods 3 x for 1 min. each, then furnace temp. 0.5 °C below FP			in furnace	t_{FP} -0.4 K
Method of forming inner liquid/solid interface	chilling	chilling		chilling	chilling
If by chilling, give method (glass rods, gas, etc.)	silica-glass rod	rod		rod	quartz rod
If by heating, give method (glass rods, heater, etc.)	—				
Fluid used in thermometer well for thermal contact	air	air		air	air
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?	yes	no		no	
If yes, specify the material	(from NIST)				
Duration of freeze or melt / h	11	16		>10	>10
Was cell used for freezing point? Melting point? Triple point?	FP	FP		FP	FP

Table II.3.3. Details on participant's techniques of realization of the freezing-point temperature of Cd. (cont.)

	IMGC	MSL	NRLM	NIM	KRISS
Procedure (freeze or melt)	freeze	freeze (NIST's cell)	no cell	freeze	no cell
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight	overnight		overnight	
Method of nucleation freeze or melt	induced	slow freeze			
Method of forming inner liquid/solid interface	chilling	chilling		chilling	
If by chilling, give method (glass rods, gas, etc.)	PRT	glass rods		glass rods	
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air	air		air	
Liquid fluid level in thermometer well / cm		NA			
Use of bushing with REC SPRT?	no	no		no	
If yes, specify the material					
Duration of freeze or melt / h	37	10		5	
Was cell used for freezing point? Melting point? Triple point?	FP	FP		FP	

Table II.3.4. Details on participant's techniques of realization of the freezing-point temperature of Sn.

	NIST	NML	PTB	VNIIM	BNM-INM
Procedure (freeze or melt)	freeze	freeze	freeze	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight	>4 h	> 10 h	14 h	overnight
Method of nucleation freeze or melt	outside of furnace nucleation	outside of furnace nucleation	T_{FP} - 1 K	outside furnace nucleation	
Method of forming inner liquid/solid interface	chilling	forms unaided	chilling	induced	chilling
If by chilling, give method (glass rods, gas, etc.)	glass rods	N/A	ingot 2 min in air, cool rod 1 min	two quartz rods	glass rods
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air				
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?	yes	yes	no	yes	yes
If yes, specify the material	Al	Quartz tube		Al	Pt
Duration of freeze or melt / h	>16	~ 3 hours	9	12	15
Was cell used for freezing point? Melting point? Triple point?	FP	FP	FP	FP	FP

Table II.3.4. Details on participant's techniques of realization of the freezing-point temperature of Sn. (cont.)

	SMU	**NPL**	**BIPM**	**NRC**	**NMi/VSL**
Procedure (freeze or melt)	freeze	freeze	no cells	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	14 h	~6 h		overnight	typically 12 h
Method of nucleation freeze or melt	Furnace temp. 1 °C below FP until recalescence, then nitrogen gas for 2.5 min, silica glass rod 2 x for 5 min each, then furnace temp. 0.5 °C below FP			cell outside furnace in air	cell outside furnace to nucleate, t_{FP} - >20 K
Method of forming inner liquid/solid interface	chilling	chilling		chilling	chilling
If by chilling, give method (glass rods, gas, etc.)	silica-glass rod, gas	air		rod	quartz rod
If by heating, give method (glass rods, heater, etc.)	—				
Fluid used in thermometer well for thermal contact	air	air		air	air
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?	no	no		no	no
If yes, specify the material	—				
Duration of freeze or melt / h	12	22		>10	>10
Was cell used for freezing point? Melting point? Triple point?	FP	FP		FP	FP

Table II.3.4. Details on participant's techniques of realization of the freezing-point temperature of Sn. (cont.)

	IMGC	**MSL**	**NRLM**	**NIM**	**KRISS**
Procedure (freeze or melt)	freeze	freeze	freeze	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight	overnight	>5 h	overnight	2 h
Method of nucleation freeze or melt	induced	withdrawal from furnace	freeze	cell outside furnace	cell outside furnace
Method of forming inner liquid/solid interface	chilling	chilling	freeze		induced
If by chilling, give method (glass rods, gas, etc.)	cold gas	glass rods	gas		stainless steel
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air	air	air	air	air
Liquid fluid level in thermometer well / cm		NA			
Use of bushing with REC SPRT?	no	no		no	yes
If yes, specify the material					Inconel
Duration of freeze or melt / h	52	8	> 7	3	11
Was cell used for freezing point? Melting point? Triple point?	FP	FP	FP	FP	FP

Table II.3.5. Details on participant's techniques of realization of the freezing-point temperature of In.

	NIST	NML	PTB	VNIIM	BNM-INM
Procedure (freeze or melt)	freeze	freeze	freeze	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight	>4 hours	> 10 h	14 hours	overnight
Method of nucleation freeze or melt	induced	Self	T_{FP} - 1K	lowering furnace temperature	
Method of forming inner liquid/solid interface	chilling	chill		induced	chilling
If by chilling, give method (glass rods, gas, etc.)	glass rods	2x rod 1 min		two quartz rods	glass
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air	silicone oil		air	silicone oil
Liquid fluid level in thermometer well / cm					10
Use of bushing with REC SPRT?	yes	quartz tube			no
If yes, specify the material	Al				
Duration of freeze or melt / h	>16	~ 3	9	10	10
Was cell used for freezing point? Melting point? Triple point?	FP	FP	FP	FP	FP

Table II.3.5. Details on participant's techniques of realization of the freezing-point temperature of In. (cont.)

	SMU	NPL	BIPM	NRC	NMi/VSL
Procedure (freeze or melt)	no In cell	freeze	no In cell	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze		~6 h		overnight	typically 12 hours
Method of nucleation freeze or melt				in furnace	t_{FP} - 0.5 K
Method of forming inner liquid/solid interface		chilling		chilling	cold rod
If by chilling, give method (glass rods, gas, etc.)		rod		rod	quartz
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact		air		air	air
Liquid fluid level in thermometer well / cm				n/a	
Use of bushing with REC SPRT?		yes		no	
If yes, specify the material		Al			
Duration of freeze or melt / h		16		>10	>10
Was cell used for freezing point? Melting point? Triple point?		FP		FP	FP

Table II.3.5. Details on participant's techniques of realization of the freezing-point temperature of In. (cont.)

	IMGC	MSL	NRLM	NIM	KRISS
Procedure (freeze or melt)	freeze	freeze	freeze	freeze	freeze
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight	overnight	>5hrs	overnight	2 h
Method of nucleation freeze or melt	induced	slow freeze	freeze	induced	slow freeze
Method of forming inner liquid/solid interface	chilling	chilling	chilling	chilling	induced
If by chilling, give method (glass rods, gas, etc.)	PRT	glass rods	glass rod	glass rods	stainless steel
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact	air	air	air	air	air
Liquid fluid level in thermometer well / cm		NA			
Use of bushing with REC SPRT?	no	no		no	yes
If yes, specify the material					Al
Duration of freeze or melt / h	42	10		> 12	9
Was cell used for freezing point? Melting point? Triple point?	FP	FP	FP	FP	FP

Table II.3.6. Details on participant's techniques of realization of the melting-point or triple-point temperature of Ga.

	NIST	NML	PTB	VNIIM	BNM-INM
Procedure (freeze or melt)	melt	melt	melt	melt	melt
If by freezing, give length of time sample heated above melting point before nucleating freeze			> 10 h		
Method of nucleation freeze or melt	induced	melt	T_{MP} + 0.5 K	increasing furnace temperature	
Method of forming inner liquid/solid interface	immersion heater	heater			heating
If by chilling, give method (glass rods, gas, etc.)		15 min			
If by heating, give method (glass rods, heater, etc.)	40 °C for 45 m		water 40 °C	heater in thermometer well	heater
Fluid used in thermometer well for thermal contact	mineral oil	water		Water	oil
Liquid fluid level in thermometer well / cm	full, 22.5		to top of surface Ga		10
Use of bushing with REC SPRT?	yes	Quartz tube	no		
If yes, specify the material	Al				
Duration of freeze or melt / h	>16	~ 3	14	24	15
Was cell used for freezing point? Melting point? Triple point?	TP	MP	MP	MP, TP	MP

Table II.3.6. Details on participant's techniques of realization of the melting-point or triple-point temperature of Ga. (cont.)

	SMU	NPL	BIPM	NRC	NMi/VSL
Procedure (freeze or melt)	melt	melt	melt	melt	melt
If by freezing, give length of time sample heated above melting point before nucleating freeze	14 hrs				
Method of nucleation freeze or melt	chill 12 h, put into 30°C bath, then 40 min. in 40°C bath, then into 30 °C bath, then heater for 30 min		heat slightly above melting point	in furnace	NA
Method of forming inner liquid/solid interface		heating	heating	Heater	heating
If by chilling, give method (glass rods, gas, etc.)	—				
If by heating, give method (glass rods, heater, etc.)	heater	heater	heating in pulsed air furnace	Heater	warm water
Fluid used in thermometer well for thermal contact	water	oil	oil	Air	water
Liquid fluid level in thermometer well / cm	to top level of Ga	200 mm	to top level of Ga	n/a	to height of Ga
Use of bushing with REC SPRT?	no	no	no	no	
If yes, specify the material					
Duration of freeze or melt / h	min. 20	20	33	>10	6
Was cell used for freezing point? Melting point? Triple point?	MP	TP, MP	MP	MP	MP

Table II.3.6. Details on participant's techniques of realization of the melting-point or triple-point temperature of Ga. (cont.)

	IMGC	MSL	NRLM	NIM	KRISS
Procedure (freeze or melt)	melt	melt	melt	melt	melt
If by freezing, give length of time sample heated above melting point before nucleating freeze		>overnight			
Method of nucleation freeze or melt	induced	warming	heating	heating	slow melting
Method of forming inner liquid/solid interface	heating	warming		heating	induced
If by chilling, give method (glass rods, gas, etc.)					
If by heating, give method (glass rods, heater, etc.)	heater	warm water		glass rods	heater
Fluid used in thermometer well for thermal contact	alcohol	water		transformer oil	water
Liquid fluid level in thermometer well / cm	45	10		6	30.0
Use of bushing with REC SPRT?	no	no		no	yes
If yes, specify the material					Al
Duration of freeze or melt / h	150	>10		> 12	21
Was cell used for freezing point? Melting point? Triple point?	MP, TP	MP	MP	MP	MP

Table II.3.7. Details on participant's techniques of realization of the triple-point temperature of H_20.

	NIST	NML	PTB	VNIIM	BNM-INM
Procedure (freeze or melt)	Melting, one week after preparing mantle				
If by freezing, give length of time sample heated above melting point before nucleating freeze					
Method of nucleation freeze or melt	Mantle prepared with immersion cooler				
Method of forming inner liquid/solid interface	Heating				
If by chilling, give method (glass rods, gas, etc.)					
If by heating, give method (glass rods, heater, etc.)	Glass rods				
Fluid used in thermometer well for thermal contact	Water				
Liquid fluid level in thermometer well / cm	To top of well				
Use of bushing with REC SPRT?	Yes				
If yes, specify the material	Al				
Duration of freeze or melt / h					
Was cell used for freezing point? Melting point? Triple point?	TP				

Table II.3.7. Details of participant's techniques of realization of the triple-point temperature of H_20. (cont.)

	SMU	NPL	BIPM	NRC	NMi/VSL
Procedure (freeze or melt)		Melting, after preparing mantle			
If by freezing, give length of time sample heated above melting point before nucleating freeze					
Method of nucleation freeze or melt		Mantle prepared with powdered solid CO_2			
Method of forming inner liquid/solid interface		Heating			
If by chilling, give method (glass rods, gas, etc.)					
If by heating, give method (glass rods, heater, etc.)		Brass rod			
Fluid used in thermometer well for thermal contact		Water			
Liquid fluid level in thermometer well / cm		About 18 cm			
Use of bushing with REC SPRT?		No			
If yes, specify the material					
Duration of freeze or melt / h					
Was cell used for freezing point? Melting point? Triple point?		TP			

Table II.3.7. Details on participant's techniques of realization of the triple-point temperature of H_2O. (cont.)

	IMGC	MSL	NRLM	NIM	KRISS
Procedure (freeze or melt)					
If by freezing, give length of time sample heated above melting point before nucleating freeze					
Method of nucleation freeze or melt					
Method of forming inner liquid/solid interface					
If by chilling, give method (glass rods, gas, etc.)					
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact					
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?					
If yes, specify the material					
Duration of freeze or melt / h					
Was cell used for freezing point? Melting point? Triple point?					

Table II.3.8. Details on participant's techniques of realization of the triple-point temperature of Hg.

	NIST	NML	PTB	VNIIM	BNM-INM
Procedure (freeze or melt)	melt	freeze	melt	no Hg cells measured	melt
If by freezing, give length of time sample heated above melting point before nucleating freeze		>4 hours			
Method of nucleation freeze or melt	induced	Self	$T_{TP} + 0.3$ K		
Method of forming inner liquid/solid interface	warming	chill	warming		heating
If by chilling, give method (glass rods, gas, etc.)		liquid N_2 cooled Cu rod			
If by heating, give method (glass rods, heater, etc.)	copper rods		glass rod		heater
Fluid used in thermometer well for thermal contact	ethanol	alcohol	oil		alcohol
Liquid fluid level in thermometer well / cm	full, 42.5		19.0		10
Use of bushing with REC SPRT?	yes	yes			no
If yes, specify the material	Al	Quartz tube			
Duration of freeze or melt / h	>16	~ 3 hours	15 h		8 hours
Was cell used for freezing point? Melting point? Triple point?	TP	FP(TP)	TP		TP

Table II.3.8. Details on participant's techniques of realization of the triple-point temperature of Hg. (cont.)

	SMU	NPL	BIPM	NRC	NMi/VSL
Procedure (freeze or melt)	no Hg cells measured	melt	no Hg cells measured	melt	melt
If by freezing, give length of time sample heated above melting point before nucleating freeze					
Method of nucleation freeze or melt				in bath	NA
Method of forming inner liquid/solid interface				rod	NA
If by chilling, give method (glass rods, gas, etc.)					
If by heating, give method (glass rods, heater, etc.)		rod		rod	ext. heater only
Fluid used in thermometer well for thermal contact		methanol		alcohol or dry	alcohol between therm well and bushing but not in bushing
Liquid fluid level in thermometer well / cm		20.0		10 cm or 0 cm	to metal height
Use of bushing with REC SPRT?		no		no	yes
If yes, specify the material					copper
Duration of freeze or melt / h		>20 h		>10 hours	>10 hours
Was cell used for freezing point? Melting point? Triple point?		TP		TP	TP

Table II.3.8. Details on participant's techniques of realization of the triple-point temperature of Hg. (cont.)

	IMGC	MSL	NRLM	NIM	KRISS
Procedure (freeze or melt)	freeze	melt	freeze	-	melt
If by freezing, give length of time sample heated above melting point before nucleating freeze	overnight	>3.5 hrs	>5hrs		-
Method of nucleation freeze or melt	induced	warming	both		slow melting
Method of forming inner liquid/solid interface	chilling	warming		-	-
If by chilling, give method (glass rods, gas, etc.)	precooled brass rod		glass rod	-	
If by heating, give method (glass rods, heater, etc.)		SPRT	glass rod	-	
Fluid used in thermometer well for thermal contact	alcohol	ethanol	ethanol	alcohol	
Liquid fluid level in thermometer well / cm	45	18	18	full	
Use of bushing with REC SPRT?	no	no		no	yes
If yes, specify the material					Al
Duration of freeze or melt / h	34	>10	3 days	20	3
Was cell used for freezing point? Melting point? Triple point?	TP	TP	TP (both)	TP	TP

Table II.3.9. Details on participant's techniques of realization of the triple-point temperature of Ar.

	NIST	NML	PTB	VNIIM	BNM-INM
Procedure (freeze or melt)	melt	data not provided	melt	no Ar cells measured	melt
If by freezing, give length of time sample heated above melting point before nucleating freeze					
Method of nucleation freeze or melt	heating after freezing sample with liq. N_2		Ts + 20 mK		
Method of forming inner liquid/solid interface	heating				heating
If by chilling, give method (glass rods, gas, etc.)					
If by heating, give method (glass rods, heater, etc.)	heater				
Fluid used in thermometer well for thermal contact	He gas		He gas		none
Liquid fluid level in thermometer well / cm			> 30 cm		
Use of bushing with REC SPRT?	yes				no
If yes, specify the material	stainless steel				
Duration of freeze or melt / h	as long as desired but always >72 h		5 h		8 hours
Was cell used for freezing point? Melting point? Triple point?	TP		TP		TP

Table II.3.9. Details on participant's techniques of realization of the triple-point temperature of Ar. (cont.)

	SMU	NPL	BIPM	NRC	NMi/VSL
Procedure (freeze or melt)	no Ar cells measured	Melt	no Ar cells measured	Melt	data not provided
If by freezing, give length of time sample heated above melting point before nucleating freeze					
Method of nucleation freeze or melt				Heating after freezing overnight	
Method of forming inner liquid/solid interface					
If by chilling, give method (glass rods, gas, etc.)					
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact		none		He gas	
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?		No			
If yes, specify the material					
Duration of freeze or melt / h		About 3.5 hr melt		> 10 hrs	
Was cell used for freezing point? Melting point? Triple point?		TP		TP	

Table II.3.9. Details on participant's techniques of realization of the triple-point temperature of Ar. (cont.)

	IMGC	MSL	NRLM	NIM	KRISS
Procedure (freeze or melt)	data not provided	no Ar cells measured	no Ar cells measured	data not provided	no Ar cells measured
If by freezing, give length of time sample heated above melting point before nucleating freeze					
Method of nucleation freeze or melt					
Method of forming inner liquid/solid interface					
If by chilling, give method (glass rods, gas, etc.)					
If by heating, give method (glass rods, heater, etc.)					
Fluid used in thermometer well for thermal contact					
Liquid fluid level in thermometer well / cm					
Use of bushing with REC SPRT?					
If yes, specify the material					
Duration of freeze or melt / h					
Was cell used for freezing point? Melting point? Triple point?					

APPENDIX III

Immersion Curves

Immersion curves provided by the participants for SPRTs in their fixed-point cells are presented in Fig. III.1 through Fig. III.9. Not all participants provided the immersion data, although they were requested to do so in the instructions to the participants (see Appendix I). Those not providing immersion curves were: BIPM, BNM-INM, MSL (NIST Cd only) and NMi-VSL. Comments on immersion that were provided by BIPM and BNM-INM are given below.

NIM		immersion data and curves (there are some problems) - **Al** – never immersed enough - **Zn** – unusual behavior - **Cd** – never immersed enough, but nearly so (4386 may be OK) - **Sn** – may be immersed enough - **In** – probably immersed enough, although significant scatter (4386 may be OK) - **Ga** – appears to be OK - **Hg** – curves but no data; may be OK at 0.05 mK level - **Ar** – no data or curves
BIPM		SPRTs withdrawn 3 cm in Ga # 128; effect within stated uncertainties
BNM-INM	**Ar**	SPRTs raised 3 cm, in 1 cm steps, from bottom of well; temperature variation observed in accordance with predicted (in sign and magnitude)
	Hg	SPRTs raised 5 cm, in 1 cm steps, from bottom of well; temperature decreased in accordance with predicted (in sign and magnitude)
	H_2O	variation of temperature in agreement with predicted
	Ga	SPRTs raised to 1.5 cm, 3 cm and 5 cm from bottom of well; temperature variation in agreement with predicted
	In	SPRTs raised to 1.5 cm, 3 cm and 5 cm from bottom of well; temperature variation not in perfect agreement with predicted. At 3 cm, the observed value was 0.3 mK whereas theory predicts 0.1 mK. Difference included in spurious heat flux component of uncertainty. (Stated to be 0.12 mK)
	Sn	SPRTs raised to 1.5 cm, 3 cm and 5 cm from bottom of well; temperature variation not in perfect agreement with predicted. At 3 cm, the observed value was 0.14 mK whereas theory predicts 0.07 mK. Difference included in spurious heat flux component of uncertainty (Stated to be 0.05 mK)
	Zn	SPRTs raised to 3 cm and 5 cm from bottom of well; temperature variation not in perfect agreement with predicted. At 3 cm, the observed value was +0.1 mK whereas theory predicts -0.08 mK. Difference included in spurious heat flux component of uncertainty (Stated to be 0.10 mK)
	Al	SPRTs raised to 3 cm and 5 cm from bottom of well; temperature variation not in perfect agreement with predicted. At 3 cm, the observed value was +0.3 mK whereas theory predicts -0.05 mK. Difference included in spurious heat flux component of uncertainty (Stated to be 0.20 mK)

MSL	no data or curves except for NIST Cd; MSL believes immersion curves are unnecessary since they have demonstrated to their satisfaction that the SPRT readings in the various cells are independent of furnace temperature variations
NMi-VSL	no data or curves

For participants that in general provided immersion data and curves, some did not provide immersion results for a few of the fixed points. These are listed below by fixed point.

Al	NML and NRLM did not provide any data
Cd	KRISS, NPL, NRLM, PTB and SMU did not provide any data because they have no cells
In	NML and SMU did not provide any data; SMU has no cell
Ga	NML and NRLM did not provide any data
H_2O	IMGC, NIM, NML, NPL and NRC did not provide any data
Hg	NIM, NML, SMU and VNIIM did not provide any data; SMU and VNIIM have no cells
Ar	IMGC, KRISS, NIM, NML, NPL, NRC, NRLM, PTB, SMU and VNIIM did not provide any data; KRISS, NRLM, SMU and VNIIM have no cells

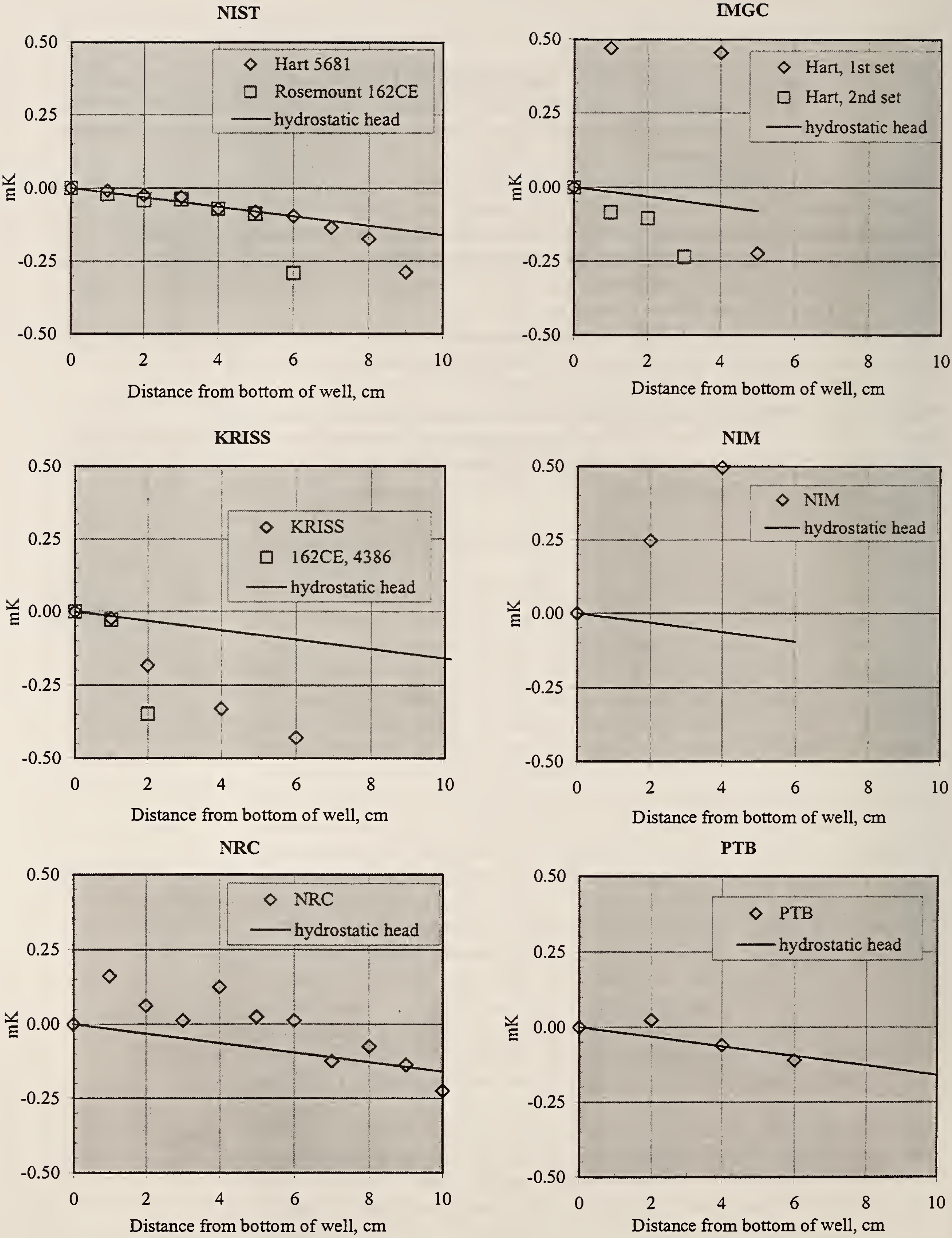


Figure III.1. Immersion curves for the various participants for aluminum.

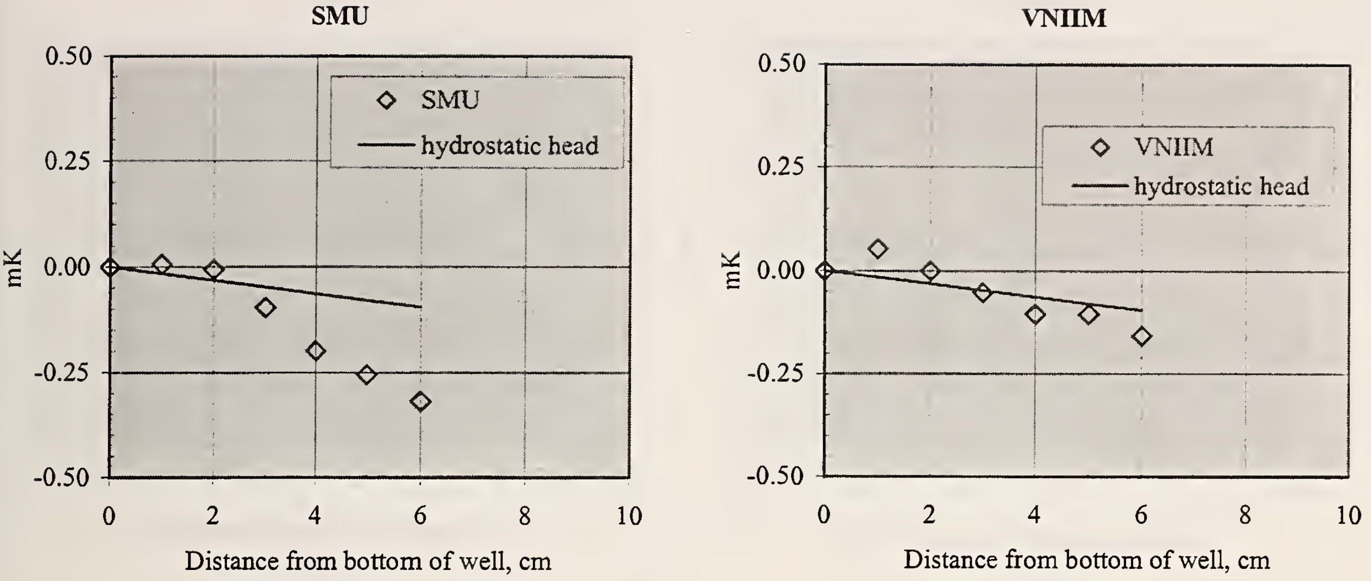


Figure III.1. Immersion curves for the various participants for aluminum. (continued)

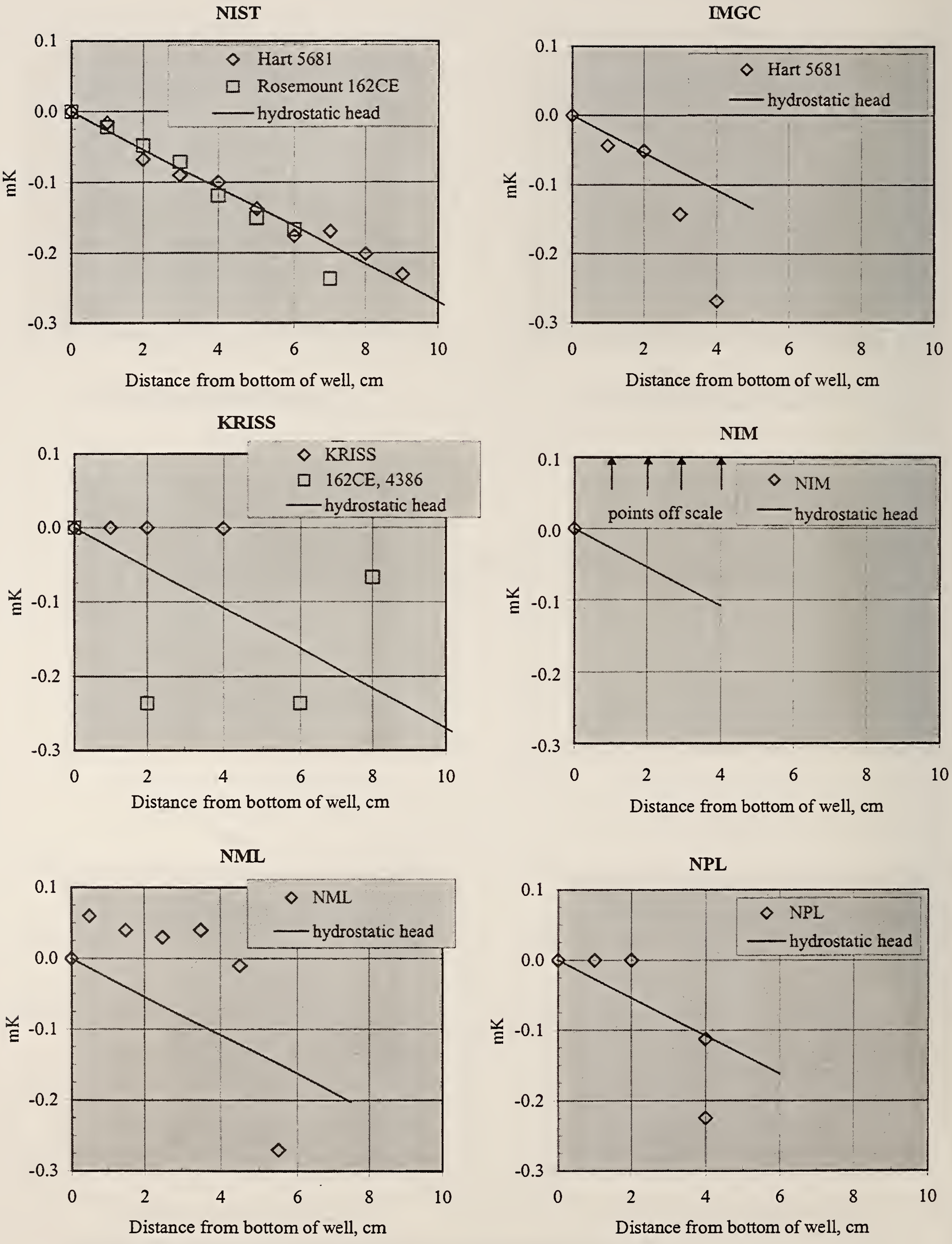


Figure III.2. Immersion curves for the various participants for zinc.

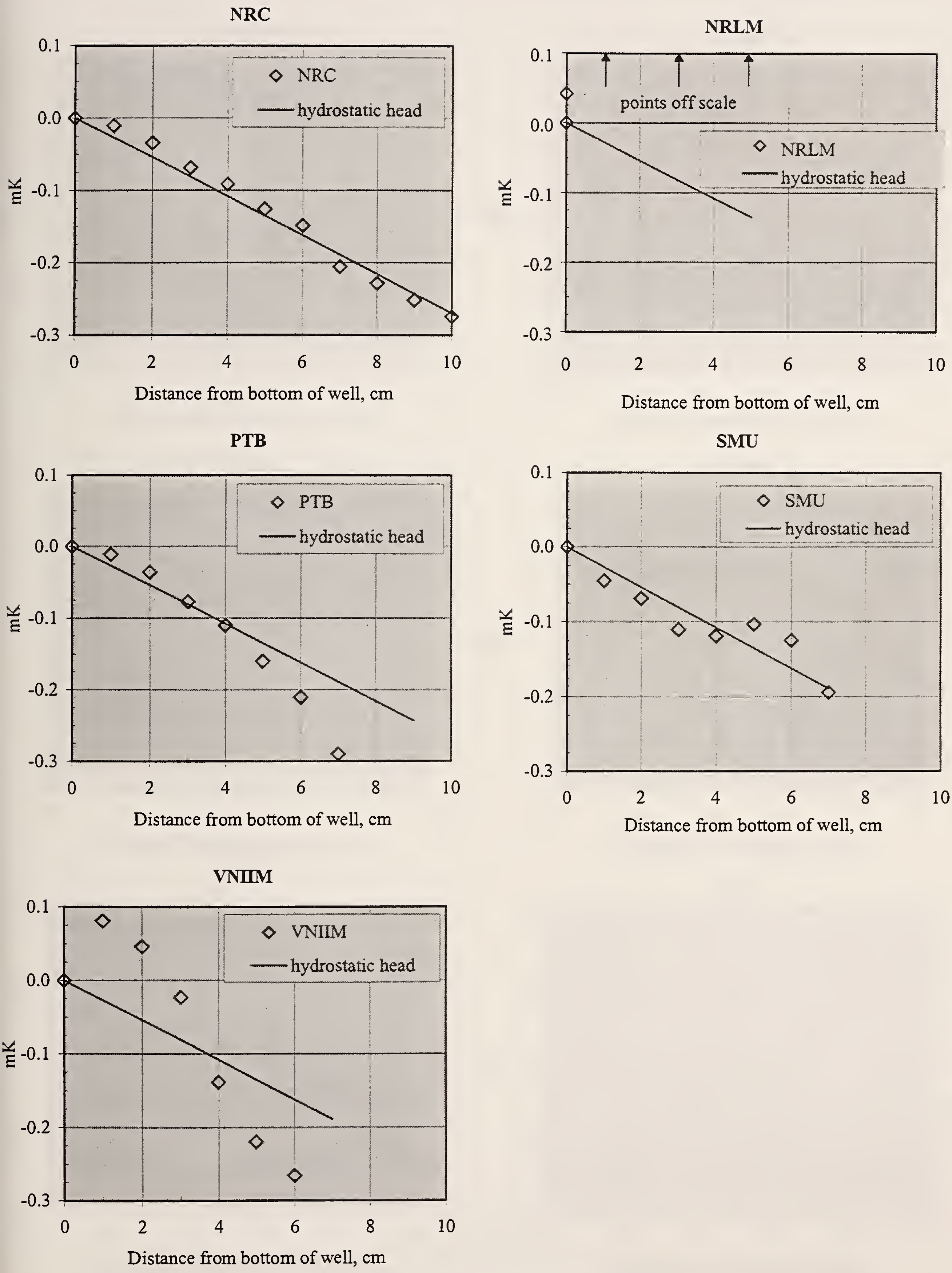


Figure III.2. Immersion curves for the various participants for zinc. (continued)

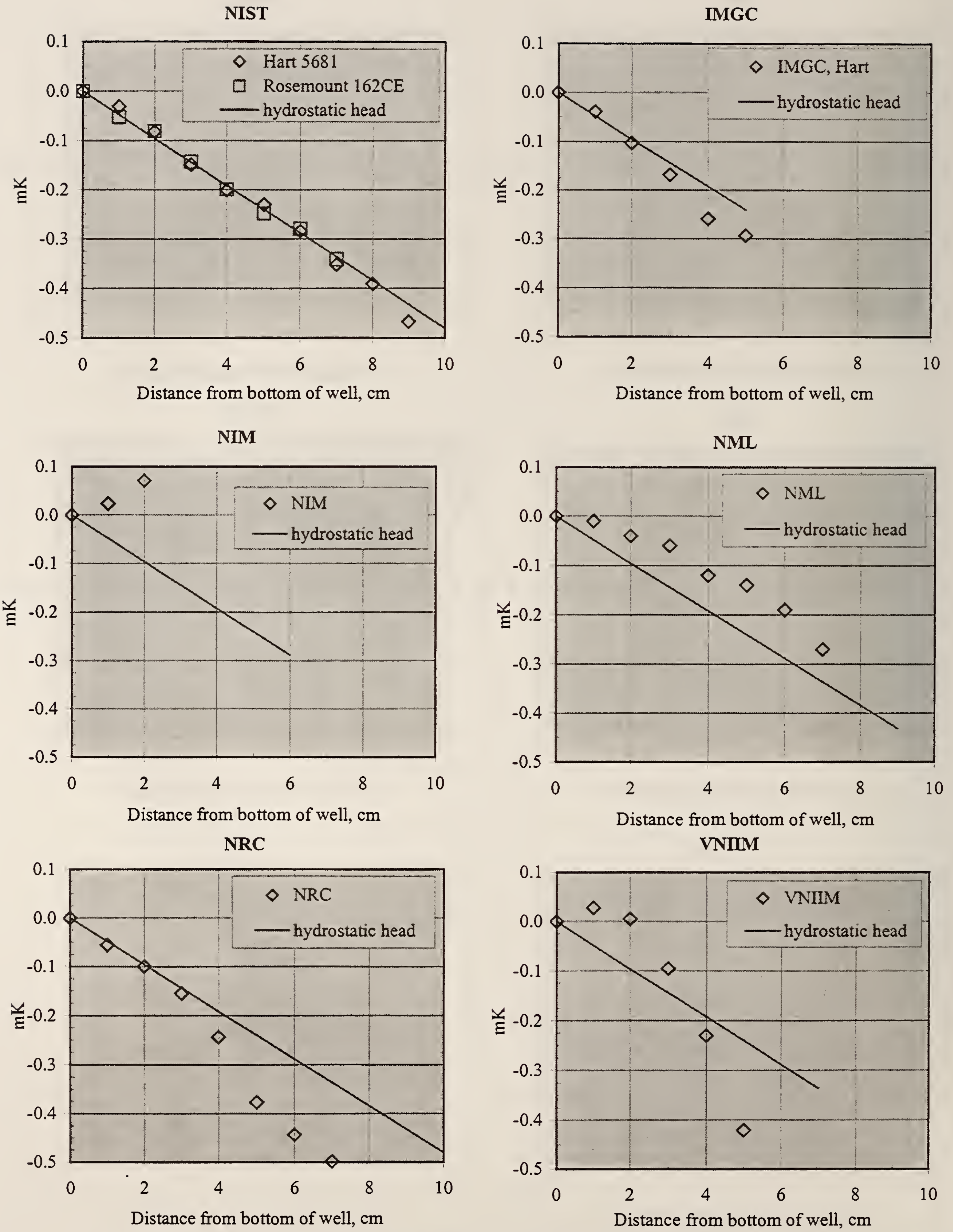


Figure III.3. Immersion curves for the various participants for cadmium.

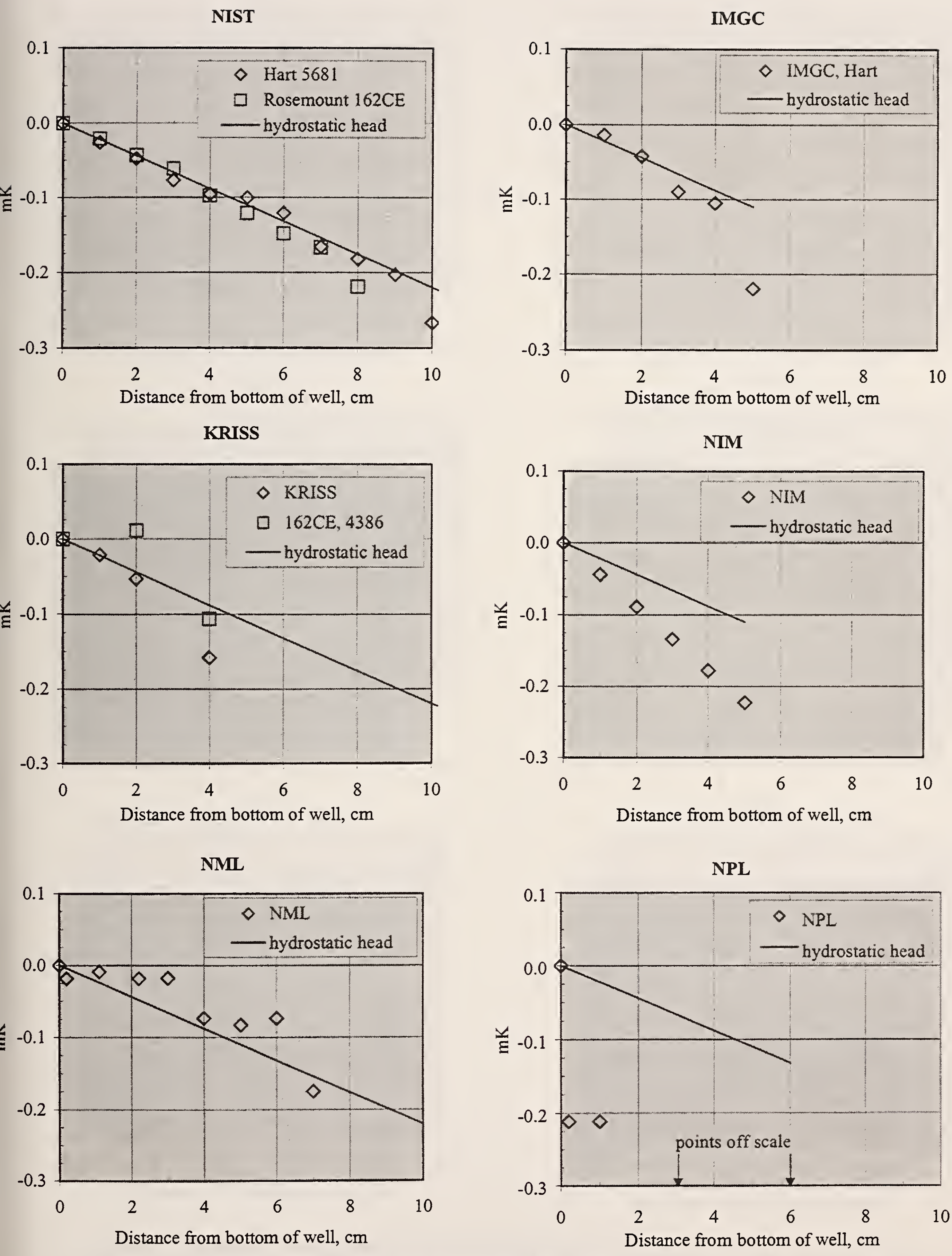


Figure III.4. Immersion curves for the various participants for tin.

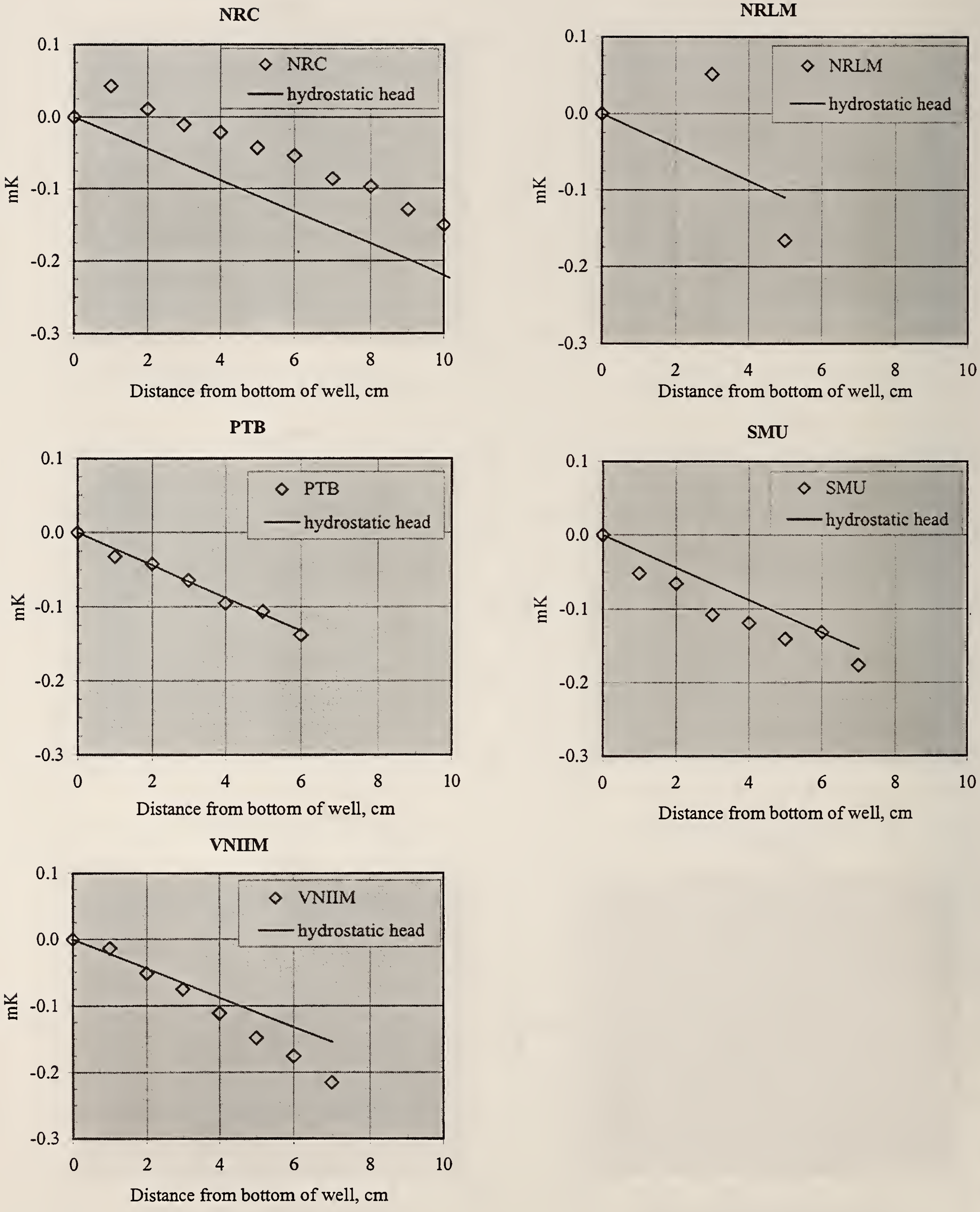


Figure III.4. Immersion curves for the various participants for tin. (continued)

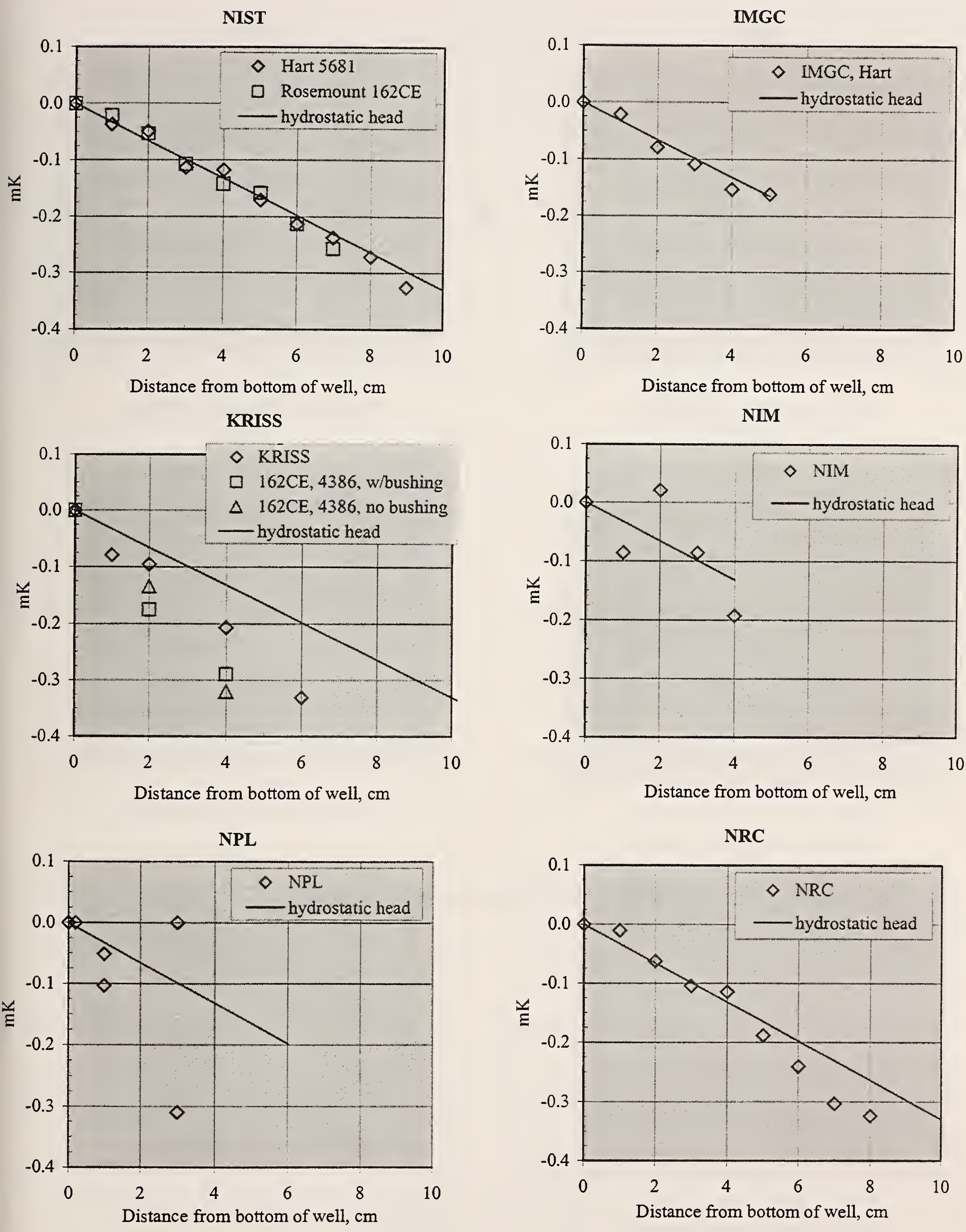


Figure III.5. Immersion curves for the various participants for indium.

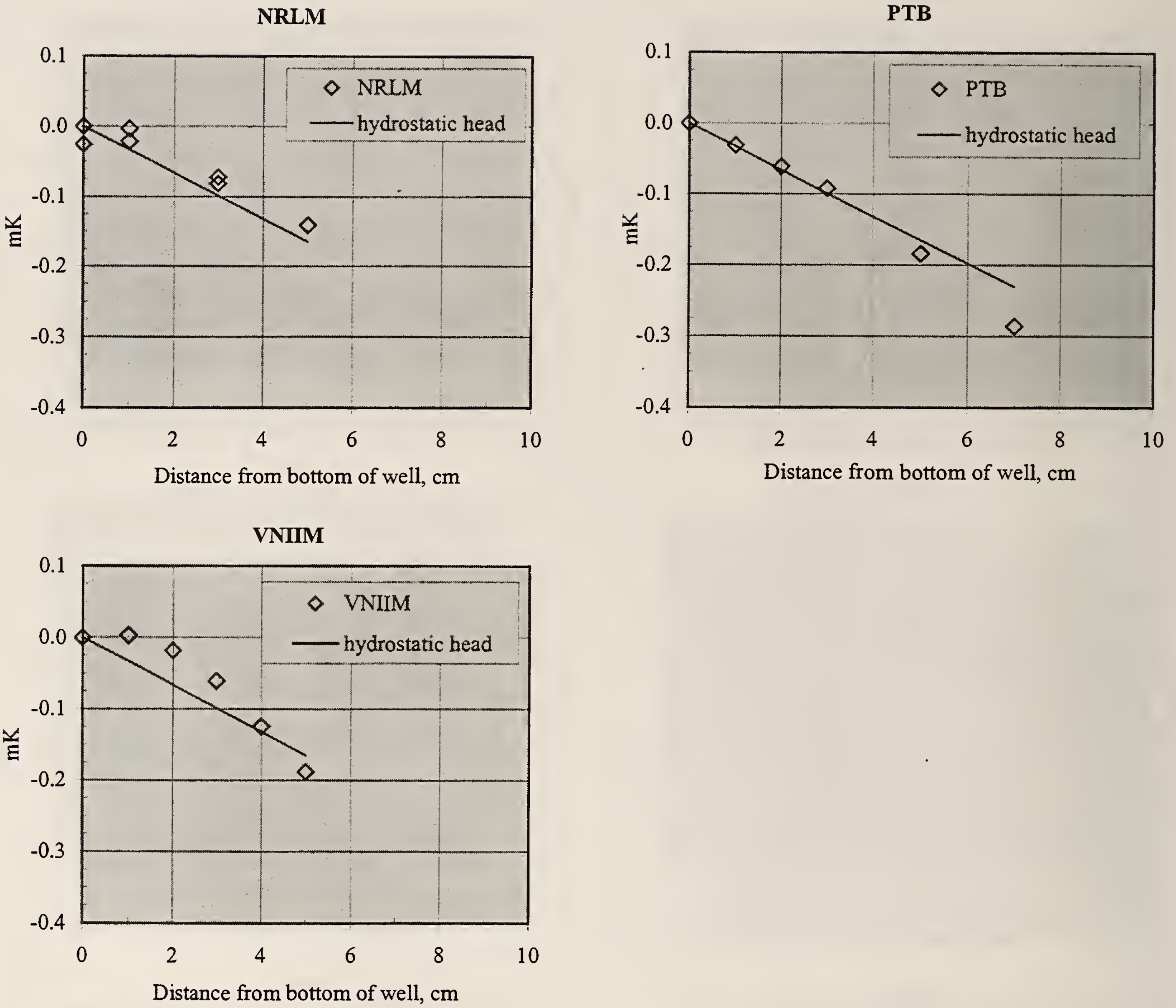


Figure III.5. Immersion curves for the various participants for indium. (continued)

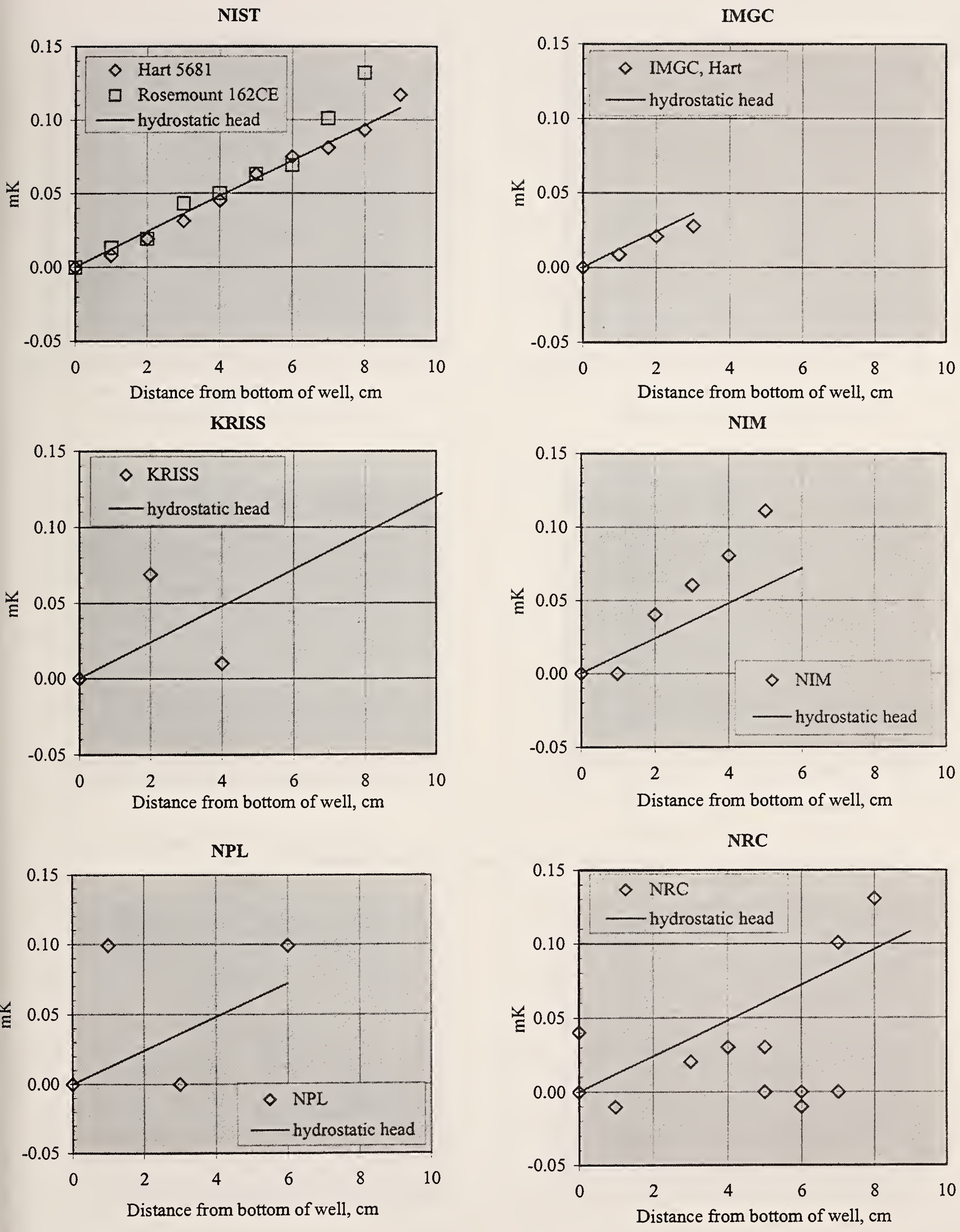


Figure III.6. Immersion curves for the various participants for gallium.

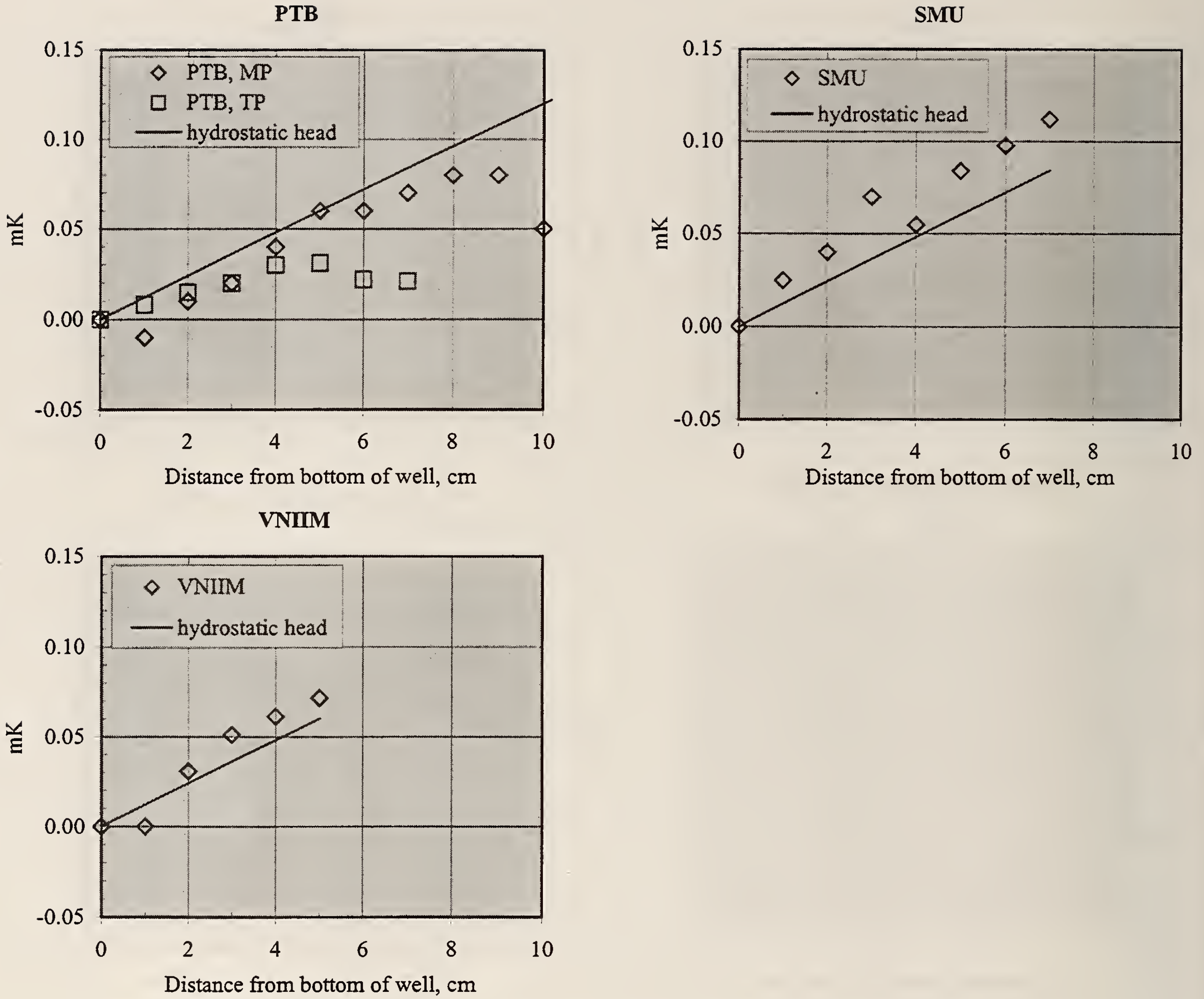


Figure III.6. Immersion curves for the various participants for gallium. (continued)

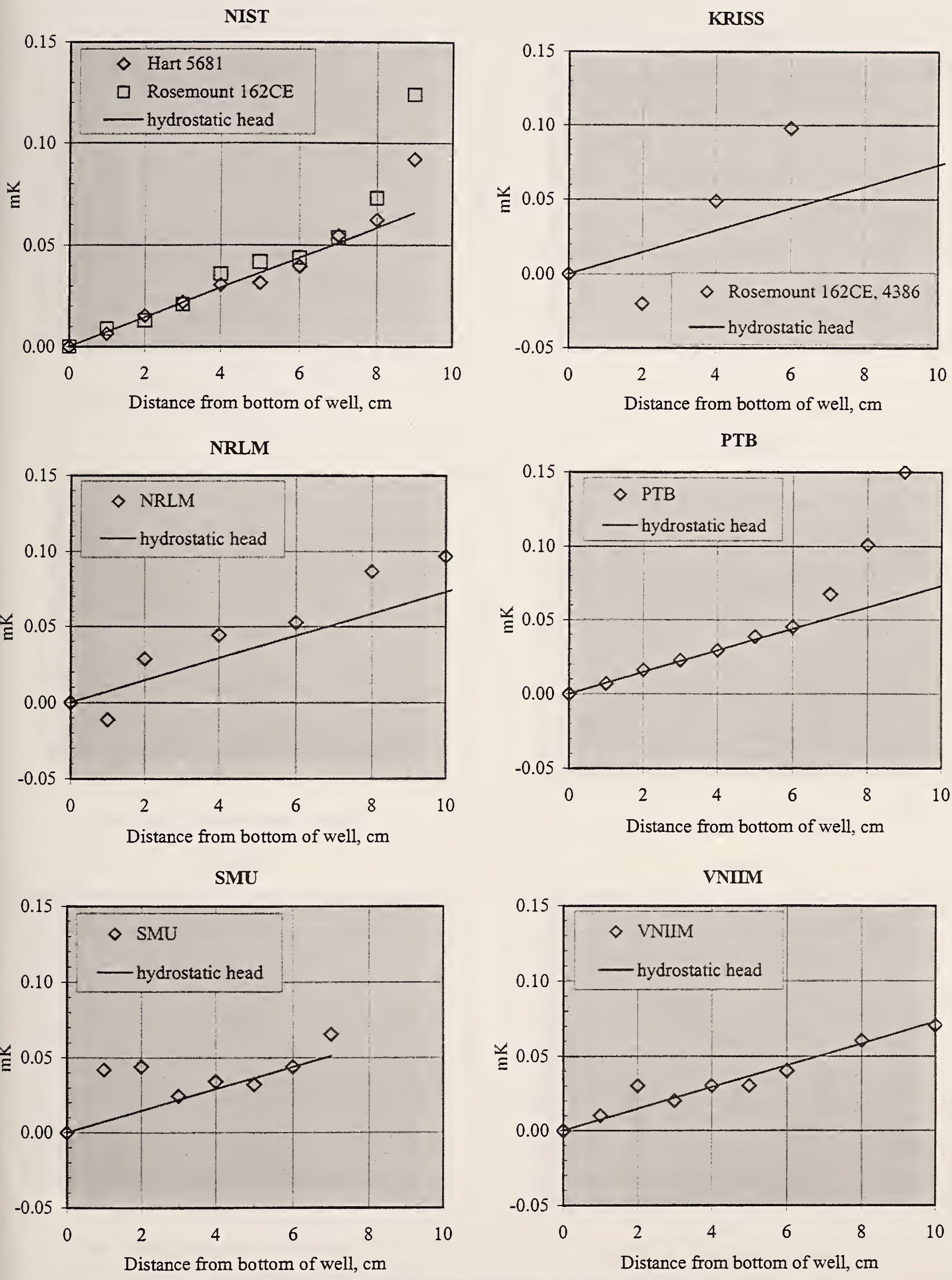


Figure III.7. Immersion curves for the various participants for water.

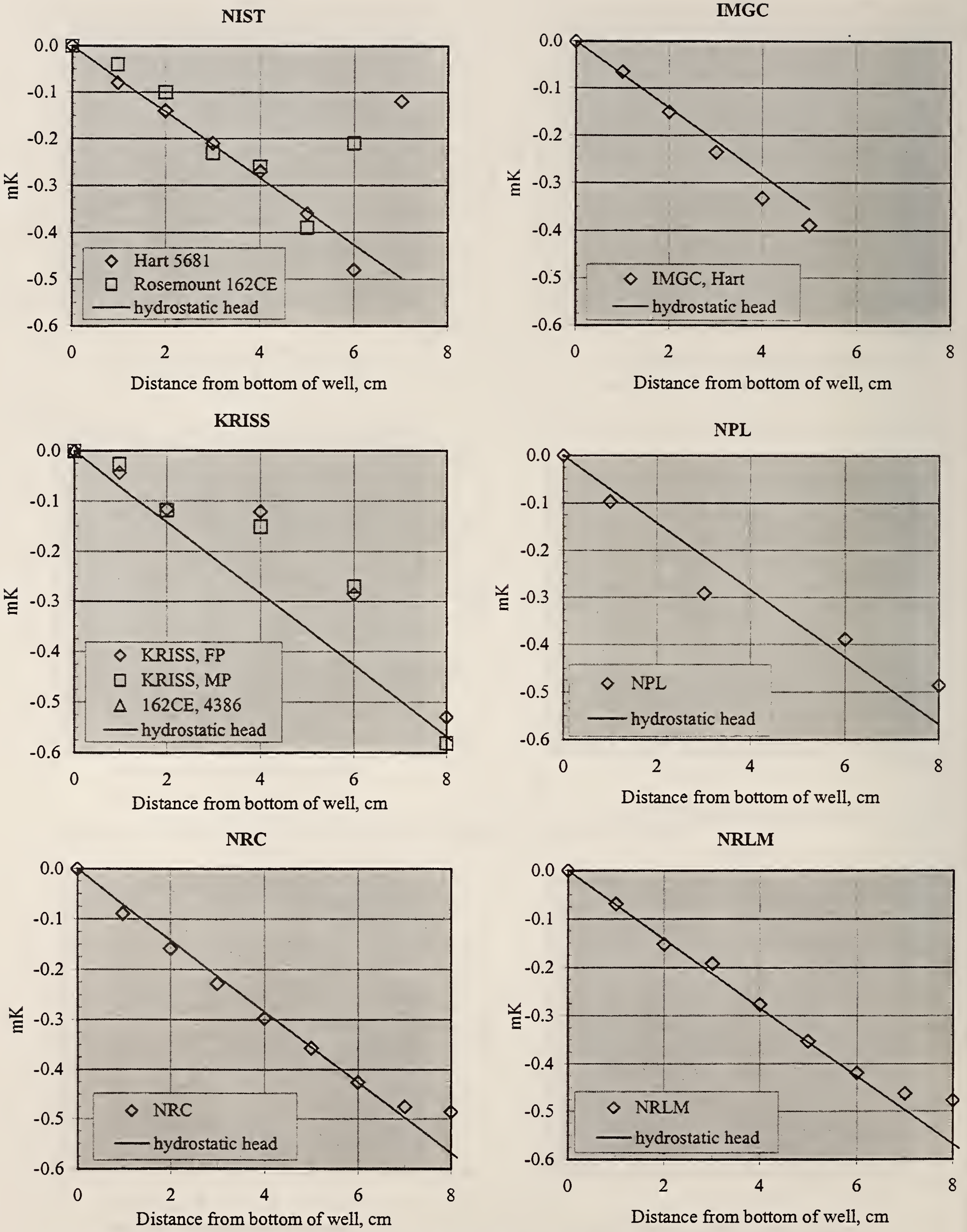


Figure III.8. Immersion curves for the various participants for mercury.

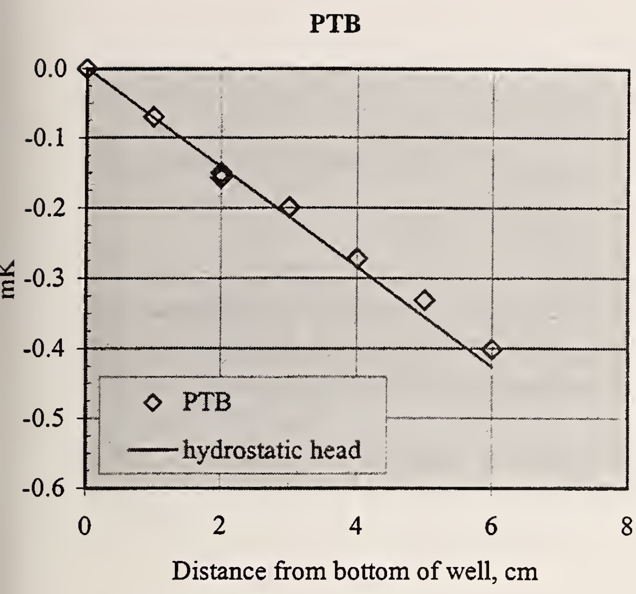


Figure III.8. Immersion curves for the various participants for mercury. (continued)

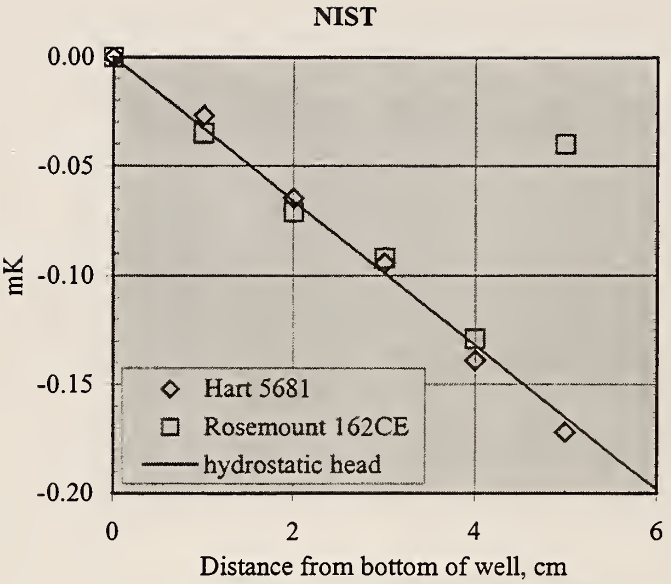


Figure III.9. Immersion curves for the various participants for argon.

Appendix IV

Uncertainty Budgets

The suggested components of the uncertainty budget, in addition to the standard deviation, for key comparison 3 were provided to the participants by the coordinating laboratory, after consultation with the sub-coordinating laboratories and with the chairman of the CCT Working Group 3. Those suggested components are given in Table IV.1(a), IV.1(b) and IV.1(c).

In this Appendix IV, we also give in Table IV.2 through Table IV.16 the detailed uncertainty budgets, provided by the participating laboratories, leading to the expanded uncertainty values in the results reported by the participants.

Table IV.1(a). The uncertainty budget reported should include the following.

COMPONENTS OF UNCERTAINTY BUDGET FOR THE TRIPLE POINT OF WATER

1. Chemical impurities
2. Hydrostatic-head errors (due to error in location of SPRT sensor)
3. Bridge-measurement errors
   - effects of changes in reference resistor(s) (due to temperature changes, etc.)
   - repeatability of bridge readings
   - non-linearity of bridge
   - quadrature effects in ac measurements
4. SPRT self-heating errors
5. Heat flux – immersion errors
6. Effects of moisture on leads, etc. on the measurements
7. Effects of isotopic variations
8. Residual gas pressure in cell (must be of the order of only a few μK if cell is acceptable for use)

Table IV.1(b). The uncertainty budget reported should include the following.

COMPONENTS OF UNCERTAINTY BUDGET FOR W AT THE TRIPLE POINT/MELTING POINT/FREEZING POINT, AS APPROPRIATE, OF

Ar, Hg, Ga, In, Sn, Cd, Zn and Al

1. Chemical impurities
2. Hydrostatic-head errors (due to error in location of SPRT sensor)
3. Bridge-measurement errors
    - effects of changes in reference resistor(s) (due to temperature changes, etc.)
    - repeatability of bridge readings
    - non-linearity of bridge
    - quadrature effects in ac measurements
4. Uncertainty propagated from the TPW
5. SPRT self-heating errors
6. Heat flux – immersion errors
7. Effects of moisture on leads, etc. on the measurements
8. Errors in gas pressure in the fixed-point cell
9. Errors in choice of fixed-point value as derived from plateau of the melt/freeze
10. High-temperature insulation degradation of SPRT

Table IV.1(c). The uncertainty budget reported should include the following.

UNCERTAINTY BUDGET FOR THE COMPARISON OF FIXED-POINT CELLS

1. Hydrostatic-head errors (due to error in location of SPRT sensor; must include error in attaining equal fraction of material frozen in the different cells)
2. Adequacy of immersion errors
3. SPRT self-heating errors
4. Bridge-measurement errors
    - effects of changes in reference resistor(s) (due to temperature changes, etc.)
    - repeatability of bridge readings
    - quadrature effects in ac measurements
5. Effects of moisture on leads, etc. on the measurements

Table IV.2. BIPM uncertainty budget for the gallium melting point and the triple point of water, expressed in mK.

		H_2O mK	Ga mK
Type A			
	Bridge Measurement (standard deviation of the mean S for n = 10)	**0.017**	**0.017**
	ΔR from ΔT of ref. Resistor		
	non-linearity		
	quadrature effects in ac meas.		
Type B			
	Chemical Impurities		
	Hydrostatic-head (residual from fit to theory)	0.017	0.017
	SPRT self-heating	0.019	0.019
	Immersion (unc. in position of sensor + unc. in ht. of liq. column)		
	Gas pressure		
	ΔR from ΔT of ref. Resistor	0.013	0.013
	Fixed-point realization	0.052	0.058
	Stray thermal exchanges	0.029	
	Bridge accuracy	0.035	0.035
Total B		**0.075**	**0.074**
Combined Standard Uncertainty		**0.08**	**0.08**
Expanded Uncertainty (*k*=2)		**0.16**	**0.16**

Table IV.3(a). BNM-INM uncertainty budget for the fixed points other than the triple point of water, expressed in mK.

	Ar SPRT 1030	**Ar** SPRT 4385	**Hg** SPRT 1030	**Hg** SPRT 4385
Type A				
Repeatability	**0.10**	**0.13**	**0.05**	**0.05**
Type B				
Chemical Impurities (from rectangular distribution of largest spread of temperatures among cells)	0.05	0.05	0.25	0.25
Hydrostatic Head	0.03	0.03	0.07	0.07
Bridge Measurement	0.10	0.10	0.06	0.06
Propagated TPW unc..	0.02	0.02	0.07	0.07
Self-heating	0.05	0.03	0.05	0.03
Spurious Heat-flux	0.20	0.25	0.05	0.05
Moisture	0.00	0.00	0.00	0.00
Residual Gas				
Total B	**0.24**	**0.28**	**0.28**	**0.28**
Combined Standard Uncertainty	**0.257**	**0.307**	**0.289**	**0.286**
Expanded uncertainty (*k*=2)	**0.51**	**0.61**	**0.58**	**0.57**

Table IV.3(a), cont'd. BNM-INM uncertainty budget for the fixed points other than the triple point of water, expressed in mK.

	Ga	**Ga**	**In**	**In**	**Sn**	**Sn**	**Zn**	**Zn**	**Al**	**Al**
	SPRT 1030	SPRT 4385	SPRT 1030	SPRT 4385	SPRT 1030	SPRT 4385	SPRT 1030	SPRT 4385	SPRT 1030	SPRT 4385
Type A										
Repeatability	**0.04**	**0.03**	**0.10**	**0.1**	**0.27**	**0.1**	**0.35**	**0.46**	**0.1**	**0.1**
Type B										
Chemical impurities (from rectangular distribution of largest spread of temperatures among cells)	0.06	0.06	0.24	0.24	0.4	0.4	0.35	0.35	1	1
Hydrostatic Head	0.004	0.004	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Bridge Measurement	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.18	0.18
Stability of the standard resistor temperature	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05
Self-heating	0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06	0.06	0.06
Spurious Heat-flux	0.03	0.03	0.12	0.12	0.05	0.05	0.10	0.10	0.20	0.20
Calibration point chosen in transition	0.03	0.03	0.1	0.1	0.1	0.1	0.10	0.10	0.30	0.30
Propagated TPW unc.	0.1	0.1	0.15	0.15	0.17	0.17	0.23	0.23	0.30	0.31
Total B	**0.14**	**0.14**	**0.33**	**0.33**	**0.46**	**0.46**	**0.45**	**0.45**	**1.12**	**1.12**
Combined Standard Uncertainty	**0.148**	**0.146**	**0.346**	**0.346**	**0.532**	**0.469**	**0.572**	**0.645**	**1.126**	**1.129**
Expanded Uncertainty (*k*=2)	**0.30**	**0.29**	**0.69**	**0.69**	**1.06**	**0.94**	**1.14**	**1.29**	**2.25**	**2.26**

Table IV.3(b). BNM-INM uncertainty budget for the triple point of water, expressed in mK.

	TPW	**TPW**
	SPRT 1030	SPRT 4385
Type A		
Repeatability	**0.03**	**0.04**
Type B		
Chemical Impurities	0.035	0.035
Hydrostatic Head	0.002	0.002
Bridge Measurement	0.060	0.060
Self-heating	0.030	0.030
Spurious Heat-flux	0.030	0.030
Effects of moisture	0.015	0.015
Total Type B	**0.083**	**0.083**
Combined Standard Uncertainty	**0.088**	**0.092**
Expanded Uncertainty (*k*=2)	**0.18**	**0.18**

Table IV.4(a). IMGC uncertainty budget for the fixed points other than the triple point of water, expressed in mK.

		Ar	**Hg**	**Ga**	**In**	**Sn**	**Cd**	**Zn**	**Al**
Type A	Freeze-to-freeze repeatability	**0.187**	**0.041**	**0.053**	**0.149**	**0.098**	**0.147**	**0.271**	**0.468**
	n	5	12	12	7	8	9	8	9
Type B	Chemical Impurities (using Raoult's Law)	0.028	0.115	0.008	0.270	0.175	0.274	0.312	0.387
	Hydrostatic-head error	0.006	0.02	0.002	0.006	0.004	0.01	0.005	0.009
	Bridge Measurement								
	-Effects of Changes in reference resistor	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	-Repeatability of bridge	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
	-Non-linearity of bridge	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	-Quadrature effects in ac measurements	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Uncertainty propagated from the TPW	0.005	0.019	0.025	0.036	0.043	0.05	0.058	0.076
	SPRT self-heating error	0.004	0.006	0.007	0.008	0.008	0.008	0.007	0.007
	Heat flux - immersion error	0.115	0.006	0.003	0.012	0.017	0.023	0.035	0.040
	Effects of moisture on leads			0.001					
	Gas pressure in fixed-point cell	0.003	0.001	0.001	0.035	0.023	0.052	0.029	0.046
	Choice of fixed-point value as derived from plateau of the melt/freeze	0.058	0.003	0.005	0.006	0.006	0.012	0.012	0.087
	High-temperature insulation degradation of SPRT							0.003	0.029
	Type A (includes SPRT 'instability')	**0.187**	**0.047**	**0.078**	**0.154**	**0.318**	**0.354**	**0.522**	**0.968**
	Total Type B	**0.132**	**0.119**	**0.029**	**0.275**	**0.183**	**0.285**	**0.321**	**0.410**
	Combined Standard uncertainty	**0.229**	**0.128**	**0.083**	**0.315**	**0.367**	**0.454**	**0.613**	**1.051**
	Expanded uncertainty	**0.458**	**0.255**	**0.166**	**0.631**	**0.734**	**0.909**	**1.226**	**2.102**

Table IV.4(b). IMGC uncertainty budget for the triple point of water, expressed in mK.

		TPW
Type A		**0.037**
	n	18
Type B	Chemical Impurities	0.006
	Hydrostatic-head error	0.001
	Bridge Measurement	
	-Effects of Changes in reference resistor	0.001
	-Repeatability of bridge	0.006
	-Non-linearity of bridge	0.001
	-Quadrature effects in ac measurements	0.001
	SPRT self-heating error	0.006
	Heat flux-immersion error	0.001
	Effects of moisture on leads	0.001
	Effects of isotopic variations	0.006
	Residual gas pressure in cell	0.001
	Type A	**0.037**
	Total Type B	**0.012**
	Combined Standard uncertainty	**0.039**
	Expanded uncertainty	**0.078**

Table IV.5(a). KRISS uncertainty budget for the fixed points other than the triple point of water, expressed in mK.

Source of uncertainty	Standard uncertainty (mK)					
	Hg	**Ga**	**In**	**Sn**	**Zn**	**Al**
Type A						
Reproducibility (std. dev. of the mean of multiple freezes)	**0.06**	**0.06**	**0.06**	**0.15**	**0.19**	**0.38**
Number of freezes	10	10	10	7	7	7
Type B (not corrected for distribution)						
Chemical impurity (using Raoult's Law)	0.002	0.014	0.470	0.300	0.540	0.670
Hydrostatic-head errors	0.054	0.012	0.033	0.022	0.027	0.016
Bridge measurement errors						
- Effects of changes in reference resistor	0.03	0.003	0.005	0.006	0.009	0.013
- Repeatability of bridge reading at TPW	0.03	0.03	0.03	0.03	0.03	0.03
- Non-linearity of bridge	0.010	0.025	0.030	0.010	0.007	0.005
- Quadrature effects in ac measurements	-	-	-	-	-	-
- Uncertainty propagated from the TPW	0.02	0.02	0.18	0.21	0.29	0.43
SPRT self-heating errors	0.02	0.02	0.07	0.09	0.09	0.11
Heat flux- immersion errors	0.030	0.002	0.045	0.040	0.040	0.080
Effects of moisture on leads, etc.	-	-	-	-	-	-
Errors in gas pressure in the fixed points	0.04	0.01	0.03	0.02	0.03	0.05
Errors in choice of fixed-points value	0.05	0.05	0.20	0.10	0.20	0.20
Extracted from the freezing or melting curves						
High temperature insulation degradation of SPRT	-	-	-	-	-	-
Total B	**0.099**	**0.073**	**0.551**	**0.393**	**0.654**	**0.834**
Total B / sqrt 3	**0.057**	**0.042**	**0.318**	**0.227**	**0.378**	**0.482**
Combined standard uncertainty	**0.08**	**0.07**	**0.33**	**0.27**	**0.42**	**0.61**
Expanded uncertainty (*k*=2), mK	**0.16**	**0.14**	**0.66**	**0.54**	**0.84**	**1.22**

Table IV.5(b). KRISS uncertainty budget for the triple point of water, expressed in mK.

Type of Evaluation	Source of uncertainty	Standard uncertainty (mK)
Type A	Reproducibility (standard deviation of the mean, n=10)	**0.016**
Type B (not corrected for distribution)	Chemical impurity	-
	Hydrostatic-head error	0.007
	Bridge measurement error	
	- Effects of changes in reference resistor	0.003
	- Repeatability of bridge reading at TPW	0.03
	- Non-linearity of bridge	0.022
	- Quadrature effects in ac measurements	-
	SPRT self-heating error	0.02
	Heat flux- immersion error	0.012
	Effects of moisture on leads, etc.	-
	Effects of isotopic variation	-
	Residual gas pressure in cell	-
	Sub-total of Type B, mK	**0.045**
	Sub-total of Type B / sqrt 3, mK	**0.026**
	Combined standard uncertainty, mK	**0.031**
	Expanded uncertainty (*k*=2), mK	**0.062**

Table IV.6(a). MSL uncertainty budget for fixed points except the triple point of water, expressed in mK.

	Zn		**Sn**		**In**		**Ga**		**Hg**	
	SPRT 541	SPRT 1032	SPRT 541	SPRT 1032	SPRT 541	SPRT 1032	SPRT 541	SPRT 1032	SPRT 541	SPRT 1032
Type A	**0.89**		**0.35**		**0.20**		**0.01**		**0.09**	
Type B										
Chemical Impurity (using Raoult's Law)	0.26	0.26	0.15	0.15	0.24	0.24	0.07	0.07	0.00	0.00
Immersion	0.02	0.02	0.02	0.02	0.03	0.03	0.01	0.01	0.07	0.07
Bridge	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04
Propagated TPW	0.38	0.39	0.27	0.27	0.22	0.22	0.15	0.15	0.11	0.11
Self-heating	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00
Heat flux	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Leads	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.10	0.10
Plateau	0.01	0.01	0.00	0.00	0.02	0.02	0.01	0.01	0.04	0.04
Insulation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total B	**0.47**	**0.47**	**0.31**	**0.31**	**0.33**	**0.33**	**0.18**	**0.18**	**0.17**	**0.18**
Combined standard uncertainty	**1.01**	**0.47**	**0.47**	**0.31**	**0.39**	**0.33**	**0.18**	**0.18**	**0.19**	**0.18**
Expanded uncertainty	**2.01**	**0.94**	**0.94**	**0.62**	**0.77**	**0.66**	**0.36**	**0.36**	**0.38**	**0.36**

Table IV.6(b). MSL uncertainty budget for the triple point of water, expressed in mK.

	TPW	
	SPRT 541	SPRT 1032
Type A		
Type B		
impurity	0.12	0.12
Hydrostatic head	0.01	0.01
bridge	0.04	0.04
self-heating	0.00	0.00
heat flux	0.01	0.01
leads	0.00	0.00
isotope	0.04	0.04
pressure	0.01	0.01
Total B	**0.13**	**0.13**
Combined standard uncertainty	**0.13**	**0.13**
Expanded uncertainty	**0.26**	**0.26**

Table IV.7(a). NIM uncertainty budget for the fixed points other than the triple point of water, expressed in mK.

		Ar	Hg	Ga	In	Sn	Cd	Zn	Al
Type A (std. dev. of mean)		**0.1**	**0.1**	**0.06**	**0.15**	**0.20**	**0.43**	**0.20**	**0.60**
	n	7	7	8	8	8	6	8	8
Type B									
	Chemical Impurities (using Raoult's Law or temperature difference between FP and MP)	0.08	0.08	0.2	0.25	1.5	0.3	0.12	0.4
	Hydrostatic-head error	0.02	0.04	0.01	0.02	0.01	0.03	0.02	0.01
	Bridge Measurement								
	-Effects of changes in reference resistors	0.01	0.01	0.03	0.05	0.06	0.07	0.08	0
	-Non-linearity of bridge	0.01	0.03	0.04	0.05	0.06	0.08	0.09	0.13
	-Repeatability of bridge	0.01	0.02	0.03	0.05	0.06	0.07	0.08	0.12
	Uncertainty propagated from the TPW	0.02	0.09	0.13	0.2	0.23	0.28	0.33	0.47
	SPRT self-heating error	0.01	0.01	0.01	0.06	0.01	0.04	0.01	0.03
	Heat flux - immersion error	0.06	0.04	0.06	0.03	0.08	0.02		0.24
	Gas pressure in fixed-point cell			0.02	0.06	0.19	0.07	0.05	0.08
	Choice of fixed-point value as derived from plateau of the melt/freeze			0.02	0.02	0.11	0.01	0.08	0.14
	Type A (from above)	**0.10**	**0.10**	**0.06**	**0.15**	**0.20**	**0.43**	**0.20**	**0.60**
	Total Type B	**0.11**	**0.14**	**0.25**	**0.34**	**1.54**	**0.44**	**0.39**	**0.70**
	Combined Standard Uncertainty	**0.15**	**0.17**	**0.26**	**0.38**	**1.55**	**0.62**	**0.44**	**0.93**
	Expanded Uncertainty	**0.29**	**0.34**	**0.52**	**0.75**	**3.10**	**1.23**	**0.88**	**1.85**

Table IV.7(b). NIM uncertainty budget for the triple point of water, expressed in mK.

		TPW
Type A (std. dev. of mean)		**0.05**
	n	7
Type B		
	SPRT self-heating error	0.02
	Calibration uncertainty of reference resistor	0.02
	Repeatability of bridge	0.03
	Effects of changes in reference resistors	0.01
	Non-linearity of bridge	0.03
	Residual gas pressure	0.01
	Hydrostatic-head errors	0.01
	Heat flux-immersion error	0.02
	Chemical impurities	0.03
	Total Type A (from above)	**0.05**
	Total Type B	**0.06**
	Combined Standard Uncertainty	**0.08**
	Expanded Uncertainty	**0.16**

Table IV.8(a). NIST uncertainty budget for the fixed points other than the triple point of water, expressed in mK.

		Ar	**Hg**	**Ga**	**In**	**Sn**	**Cd**	**Zn**	**Al**
Type A		**mK**	**mK**	**mK**	**mK**	**mK**	**mK**	**mK**	**mK**
	Bridge Measurement								
	ΔR from ΔT of ref. Resistor	0	0	0	0	0	0	0	0
	Freeze-to-freeze repeatability	0.03	0.07	0.02	0.04	0.12	0.12	0.18	0.28
	Non-linearity quadrature effects in ac meas.	0	0	0	0	0	0	0	0
	Total A	**0.03**	**0.07**	**0.02**	**0.04**	**0.12**	**0.12**	**0.18**	**0.28**
	n	266	260	288	84	302	36	406	130
Type B									
	Chemical Impurities (Raoult's Law)	0.05/√3	0.01/√3	0.01/√3	0.05/√3	0.01/√3	0.05/√3	0.17/√3	0.27/√3
	Hydrostatic-head (residual from fit to theory)	0.0004/√3	0.0112/√3	0.0032/√3	0.0084/√3	0.0065/√3	0.0090/√3	0.0092/√3	0.0083/√3
	Propagated TPW	0.0018/√3	0.0075/√3	0.0101/√3	0.0151/√3	0.0182/√3	0.0219/√3	0.0262/√3	0.0376/√3
	SPRT self-heating	0.0136/√3	0.0146/√3	0.0149/√3	0.0155/√3	0.0159/√3	0.0164/√3	0.0169/√3	0.0184/√3
	Immersion (unc. in position of sensor + unc. in ht. of liq. column)	0.0033/√3	0.0071/√3	0.0012/√3	0.0033/√3	0.0022/√3	0.0030/√3	0.0027/√3	0.0016/√3
	Moisture	0	0	0	0	0	0	0	0
	Gas pressure	0	0	0.00001/√3	0.00001/√3	0.00001/√3	0.00001/√3	0.00001/√3	0.00002/√3
	Insulation degradation	0	0	0	0	0	0	0	0
	Total B	**0.03**	**0.01**	**0.01**	**0.03**	**0.02**	**0.03**	**0.10**	**0.16**
	Combined Standard Uncertainty	**0.04**	**0.07**	**0.02**	**0.05**	**0.12**	**0.12**	**0.21**	**0.32**
	Expanded Uncertainty (*k*=2)	**0.08**	**0.14**	**0.04**	**0.10**	**0.24**	**0.25**	**0.41**	**0.64**

Table IV.8(b). NIST uncertainty budget for the triple point of water, expressed in mK.

		TPW **mK**
Type A		
	Bridge Measurement	
	ΔR from ΔT of ref. Resistor	0.00
	Repeatability (std. dev.: n=560)	0.003
	Non-linearity quadrature effects in ac meas.	0.00
	Total A	**0.003**
Type B		
	Chemical Impurities (using Raoult's Law and 7N5 purity)	$0.0052/\sqrt{3}$
	Hydrostatic-head (residual from fit to theory)	$0.0041/\sqrt{3}$
	SPRT self-heating	$0.0148/\sqrt{3}$
	Immersion (unc. in position of sensor + unc. in height of liq. Column)	$0.0007/\sqrt{3}$
	Moisture	0
	Gas pressure	0
	Insulation degradation	0
	Total B	**0.01**
	Combined Standard Uncertainty	**0.01**
	Expanded Uncertainty (*k*=2)	**0.02**

Table IV.9. NML uncertainties, expressed in µK.

SPRT 4386	**Ar**	**Hg**	**TPW**	**Ga**	**In**	**Sn**	**Cd**	**Zn**	**Al**
Purity	400	100	25	100	400	100	100	100	250
Fixed point realization	250	50	5	50	50	50	50	75	150
Isotope			25						
Noise	12	13	13	13	14	14	14	15	16
Ref. Resistor		5		5					
Self heating	10	5	5	5	5	5	10	10	10
Non linearity	18	20		20	21	22	22	23	25
Quadrature	9	10	10	10	11	11	11	11	12
AC/DC	5	10	10	10	15	20	25	25	25
Hydrostatic		36	4	6	17	11	24	14	8
Conduction	5	5	0	5	5	5	5	5	5
Insulation			5	5	5	5	10	10	50
Gas Pressure				20	49	33	63	43	70
RSS(FP)	472	121	41	118	408	122	137	139	307
TPW before/after FP	30	30	5	35	25	30	50	65	130
propag. before/after TPW	6	25	5	39	42	61	123	190	546
TPW realization	41	41	41	41	41	41	41	41	41
Propag. TPW realization.	8	34	21	47	70	84	101	121	174
TOTALS									
Combined Uncertainty, µK (at 95% level, *k*=2)	**945**	**256**	**83**	**265**	**832**	**321**	**420**	**530**	**1301**

Table IV.9. NML uncertainties, expressed in μK (continued).

SPRT 1032	Hg	TPW	Ga	In	Sn	Cd	Zn
Purity	100	25	100	400	100	100	100
Fixed point realization	50	5	50	50	50	50	75
Isotope		25					
Noise	13	13	13	14	14	14	15
Ref. Resistor	5		5				
Self heating	5	5	5	5	5	10	10
Non linearity	20		20	21	22	22	23
Quadrature	10	10	10	11	11	11	11
AC/DC	10	10	10	15	20	25	25
Hydrostatic	36	4	6	17	11	24	14
Conduction	5	0	5	5	5	5	5
Insulation		5	5	5	5	10	10
Gas Pressure			20	49	33	63	43
RSS(FP)	121	41	118	408	122	137	139
TPW before/after FP	18	5	23	41	63	82	90
propag. before/after TPW	15	5	25	68	127	200	264
TPW realization	41	41	41	41	41	41	41
propag. WTP realization.	34	21	47	70	84	101	121
TOTALS							
Combined Uncertainty, μK (at 95% level, *k*=2)	**253**	**83**	**258**	**838**	**391**	**525**	**644**

Table IV.9. NML uncertainties, expressed in μK (continued).

SPRT 040

	Ar	**Hg**	**TPW**	**Ga**	**In**	**Sn**	**Cd**	**Zn**	**Al**
Purity	500	100	25	100	400	100	100	100	250
Fixed Point realization		50	5	50	50	50	50	75	150
Isotope			25						
Noise	12	13	13	13	14	14	14	15	16
Ref. Resistor		5		5					
Self heating	10	5	5	5	5	5	10	10	10
Non linearity	18	20		20	21	22	22	23	25
Quadrature	9	10	10	10	11	11	11	11	12
AC/DC	5	10	10	10	15	20	25	25	25
Hydrostatic		36	4	6	17	11	24	14	8
Conduction	5	5	0	5	5	5	5	5	5
Insulation			5	5	5	5	10	10	50
Gas Pressure				20	49	33	63	43	70
RSS(FP)	501	121	41	118	408	122	137	139	307
TPW before/after FP	30	30	5	35	35	35	50	55	105
propag. before/after TPW	6	25	5	39	59	71	123	161	441
TPW realization	41	41	42	41	41	41	41	41	41
Propag. TPW realization.	8	34	42	47	70	84	101	121	174
TOTALS									
Combined Uncertainty, μK (at 95% level, *k*=2)	**1002**	**256**	**83**	**265**	**836**	**329**	**420**	**490**	**1130**

Table IV.10. NPL uncertainty budget for the fixed points, expressed in mK.

		Ar	**Hg**	**H_2O**	**Ga**	**In**	**Sn**	**Zn**
		mK	**mK**	**mK**	**mK**	**mK**	**mK**	**mK**
Type A		**0.22**	**0.11**	**0.04**	**0.10**	**0.13**	**0.13**	**0.11**
	n	5	4		3	9	9	9
Type B	Chemical Impurities (use melting and freezing ranges)	0.05	0.12	0.03	0.12	0.23	0.23	0.28
	Hydrostatic-head (residual from fit to theory)	0.1	0.05	0.01	0.01	0.03	0.03	0.03
	Propagated TPW unc.	0.02	0.08		0.12	0.18	0.21	0.28
	SPRT self-heating	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Immersion (unc. in position of sensor + unc. in ht. of liq. column)	0.3	0.06	0.03	0.06	0.09	0.09	0.09
	Moisture							
	Gas pressure							
	Insulation degradation							
	Bridge measurement (ΔR from ΔT of ref. resistor, non-linearity, quadrature effects in ac meas. repeatability of bridge readings, etc.)	0.02	0.06	0.06	0.06	0.07	0.08	0.1
	Electrical effects (freq. Effects. Leakage, etc.)	0.03	0.03	0.03	0.03	0.06	0.06	0.06
Total B		**0.33**	**0.18**	**0.10**	**0.20**	**0.33**	**0.35**	**0.43**
Combined Standard Uncertainty		**0.40**	**0.21**	**0.11**	**0.22**	**0.35**	**0.37**	**0.44**
Expanded Uncertainty (*k*=2)		**0.80**	**0.42**	**0.22**	**0.44**	**0.70**	**0.74**	**0.88**

Table IV.11. NRC uncertainty budget for the fixed points, express in mK

mK equivalent for the fixed-point measurements

Fixed Point	**Ar (F13)**	**Hg-1**	**H_2O (2053)**	**Ga-1**	**In-2**	**Sn-1**	**Cd-2**	**Zn-3**	**Al-6**
Type A	**0.044**	**0.055**	**0.020**	**0.110**	**0.100**	**0.170**	**0.150**	**0.050**	**0.300**
n	10	10		10	10	10	10	10	9
Type B:									
Chemical impurities (using Raoult's Law)	0.142	0.006	0.010	0.014	0.037	0.332	0.070	0.056	0.408
Hydrostatic-head errors (2 mm)	0.000	0.014	0.001	0.002	0.007	0.004	0.010	0.005	0.003
Bridge-measurement errors	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
SPRT self-heating errors	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Uncertainty propagated from the TPW	0.009	0.036		0.048	0.069	0.081	0.095	0.110	0.144
Heat flux - immersion errors	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Effects of moisture on leads, etc.									
Errors in gas pressure	0.000	0.010	0.010	0.003	0.006	0.004	0.008	0.006	0.009
Error in choice of fixed-point value	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
High temperature insulation degradation									
Effects of isotopic variations (water only)			0.010						
Total B	**0.146**	**0.053**	**0.038**	**0.060**	**0.086**	**0.343**	**0.123**	**0.128**	**0.434**
Combined standard uncertainty	**0.152**	**0.076**	**0.043**	**0.125**	**0.132**	**0.383**	**0.194**	**0.138**	**0.528**
Expanded uncertainty	**0.306**	**0.152**	**0.085**	**0.251**	**0.263**	**0.766**	**0.388**	**0.275**	**1.056**

Table IV.12(a). NRLM uncertainty budget for fixed points except the triple point of water, expressed in mK.

		Hg mK	In mK	Ga mK	Sn mK	Zn mK	Al mK
Type A							
	Bridge Measurement						
	ΔR from ΔT of ref. Resistor	0.004	0.008	0.004	0.009	0.01	
	Freeze-to-freeze repeatability	0.15	0.42	0.02	0.17	0.28	1.01
	non-linearity	0.02	0.12	0.03	0.12	0.13	
	quadrature effects in ac meas.	0.03	0.03	0.02	0.02	0.02	
	Total A	**0.16**	**0.44**	**0.04**	**0.21**	**0.31**	**1.01**
	n	Inf.	3	Inf.	4	4	4
Type B							
	Chemical impurities (using Raoult‘s Law)	0.16	0.16	0.01	0.13	0.14	0.44
	Hydrostatic-head	0.06	0.03	0.01	0.02	0.02	
	Propagated TPW uncert.	0.07	0.13	0.09	0.15	0.21	0.27
	Propagated TPW (SPRT drift)	0.04	0.21	0.02	0.16	0.78	0.61
	SPRT self-heating	0.006	0.01	0.02	0.01	0.01	
	heat flux - Immersion error	0.04	0.1	0.02	0.19	0.21	
	Moisture	0.002	0.008	0	0.008	0.009	
	Gas pressure	0	0.003	0.006	0.002	0.002	
	Insulation degradation						
	non-uniqueness of the fixed point value	0.16	0.16	0.02	0.13	0.14	
	high temperature degradation of SPRT						
	Total B	**0.25**	**0.35**	**0.10**	**0.35**	**0.86**	**0.80**
	Combined Standard Uncertainty	**0.3**	**0.57**	**0.11**	**0.41**	**0.92**	**1.29**
	Expanded Uncertainty (*k*=2)	**0.6**	**1.13**	**0.22**	**0.82**	**1.83**	**2.58**

Table IV.12(b). NRLM uncertainty budget for the triple point of water, expressed in mK.

		mK
Type A		
	Bridge Measurement	
	ΔR from ΔT of ref. Resistor	0.00
	repeatability of bridge readings	0.006
	non-linearity	0.020
	quadrature effects in ac meas.	0.03
	Total A	**0.037**
Type B		
	Chemical Impurities	0.03
	Hydrostatic-head (residual from fit to theor.)	0.006
	SPRT self-heating	0.006
	Immersion (unc. in position of sensor + unc. in ht. of liq. column)	0.02
	Moisture	0.002
	Gas pressure	0.06
	Insulation degradation	
	isotope variation	0.006
	Total B	**0.08**
	Combined Standard Uncertainty	**0.09**
	Expanded Uncertainty (*k*=2)	**0.18**

Table IV.13(a). PTB uncertainty budget for the fixed points other than the triple point of water, expressed in mK.

	Ar	**Hg**	**Ga**	**In**	**Sn**	**Zn**	**Al**
Type A	**mK**	**mK**	**mK**	**mK**	**mK**	**mK**	**mK**
ΔR from ΔT of ref. Resistor	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Freeze-to-freeze (or melt-to-melt) repeatability	0.15	0.05	0.05	0.20	0.15	0.15	0.3
Total A	**0.15**	**0.05**	**0.05**	**0.20**	**0.15**	**0.15**	**0.30**
n	50	50	200	50	150	150	50
Type B							
Chemical Impurities (using Raoult's Law, no factor for rectangular or other distribution used)	0.2	0.06	0.06	0.47	0.31	0.54	0.4
Hydrostatic-head (residual from fit to theor.)	0.03	0.03	0.007	0.02	0.02	0.02	0.02
Propagated TPW	0.01	0.05	0.08	0.09	0.11	0.15	0.20
SPRT self-heating	0.02	0.05	0.05	0.15	0.2	0.2	0.2
Immersion (unc. in position of sensor + unc. in ht. of liq. column)	0.10	0.02	0.005	0.2	0.1	0.1	0.1
Moisture							
Gas pressure		0.01	0.005	0.1	0.08	0.12	0.6
Insulation degradation							
Choice of fixed-point value	0.14	0.07	0.03	0.06	0.06	0.06	0.2
non-linearity	0.01	0.055	0.02	0.11	0.12	0.16	0.2
quadrature effects in ac meas.							
Total B	**0.27**	**0.14**	**0.12**	**0.56**	**0.43**	**0.64**	**0.83**
Combined Standard Uncertainty	**0.31**	**0.15**	**0.13**	**0.60**	**0.45**	**0.66**	**0.88**
Expanded Uncertainty (*k*=2)	**0.61**	**0.30**	**0.26**	**1.20**	**0.91**	**1.31**	**1.77**

Table IV.13(b). PTB uncertainty budget for the triple point of water, expressed in mK.

		mK
Type A		
	ΔR from ΔT of ref. Resistor	0.010
	Realization-to-realization repeatability	0.025
	Total A	**0.027**
	n	500
Type B		
	Chemical Impurities	0.01
	Hydrostatic-head (residual from fit to theor.)	0.004
	Non-linearity	0.015
	SPRT self-heating	0.04
	Resistance of standard resistor	0.05
	Immersion (unc. in position of sensor + unc. in ht. of liq. Column)	0.01
	Moisture	
	Isotope variations	0.03
	Gas pressure	0.005
	Insulation degradation	
	Choice of fixed-point value	0.01
	Total B	**0.07**
	Combined Standard Uncertainty	**0.08**
	Expanded Uncertainty (k=2)	**0.16**

Table IV.14(a). SMU uncertainty budget for the fixed points other than the triple point of water, expressed in mK.

		Ga	**Sn**	**Zn**	**Al**
Type A		**mK**	**mK**	**mK**	**mK**
	Freeze-to-freeze repeatability (standard deviation of the mean)	0.03	0.2	0.2	0.3
	n	3	3	3	3
	Bridge Measurement				
	ΔR from ΔT of ref. Resistor	0.0012	0.0023	0.0031	0.0045
	non-linearity	0.025	0.11	0.11	0.13
	quadrature effects in ac meas.				
	Total A	**0.04**	**0.23**	**0.23**	**0.33**
Type B					
	Chemical Impurities (using Raoult's Law)	0.01	0.35	0.27	0.19
	Hydrostatic-head (residual from fit to theory)	0.006	0.018	0.022	0.013
	Propagated TPW unc.	0.076	0.13	0.17	0.23
	SPRT self-heating	0.02	0.03	0.03	0.05
	Immersion (unc. in position of sensor + unc. in ht. of liq. column)	0.025	0.05	0.05	0.1
	Moisture	0	0	0	0
	Gas pressure	0.0004	0.034	0.044	0.071
	Insulation degradation	0	0	0	0
	Choice of fixed-point value from plateau	0.03	0.08	0.08	0.1
	Total B	**0.09**	**0.39**	**0.34**	**0.34**
	Combined Standard Uncertainty	**0.10**	**0.45**	**0.41**	**0.47**
	Expanded Uncertainty (*k*=2)	**0.19**	**0.90**	**0.82**	**0.95**

Table IV.14(b). SMU uncertainty budget for the triple point of water, expressed in mK.

		TPW
Type A		
	Repeatability (standard deviation of the mean)	0.02
	Bridge Measurement	
	ΔR from ΔT of ref. Resistor	0.002
	non-linearity	0.02
	quadrature effects in ac meas.	
	Total A	**0.03**
Type B		
	Chemical Impurities	
	Hydrostatic-head (residual from fit to theor.)	0.004
	SPRT self-heating	0.03
	Immersion (unc. in position of sensor + unc. in ht. of liq. column)	0.02
	Moisture	
	Gas pressure	0.000015
	Insulation degradation	
	Effects of isotope variations	0.05
Total B		**0.06**
Combined Standard Uncertainty		**0.07**
Expanded Uncertainty (*k*=2)		**0.14**

Table IV.15(a). VNIIM uncertainties for the fixed points, except the triple point of water, expressed in mK.

	Ga mK	In mK	Sn mK	Cd mK	Zn mK	Al mK
Type A						
Freeze-to freeze repeatability (std. dev. of mean)	**0.05**	**0.20**	**0.20**	**0.40**	**0.40**	**0.40**
n	5	5	5	5	5	5
Total A	**0.05**	**0.20**	**0.20**	**0.40**	**0.40**	**0.40**
Type B						
Chemical Impurities (Using Raoult's Law)	0.025	0.12	0.08	0.09	0.13	0.14
Hydrostatic head	0.002	0.005	0.003	0.007	0.004	0.002
Propagated TPW	0.029	0.042	0.049	0.057	0.067	0.088
Effect of change in reference resistor value	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Bridge reading and non-linearity	0.003	0.003	0.003	0.003	0.003	0.003
Immersion	0.006	0.006	0.008	0.008	0.015	0.015
Moisture						
SPRT self heating	0.006	0.012	0.012	0.017	0.017	0.017
Gas pressure	0.0002	0.0006	0.0006	0.0008	0.0012	0.0025
Insulation degradation						
Choice of fixed-point value	0.006	0.014	0.014	0.014	0.015	0.03
Total B	**0.04**	**0.13**	**0.10**	**0.11**	**0.15**	**0.17**
Combined Standard Uncertainty	**0.06**	**0.24**	**0.22**	**0.41**	**0.43**	**0.43**
Expanded Uncertainty (*k*=2)	**0.12**	**0.48**	**0.44**	**0.82**	**0.86**	**0.86**

The Type A uncertainty for each fixed point is the standard deviation of the mean for five freezes.

Table IV.15(b). VNIIM uncertainties for the triple point of water, expressed in mK.

Type A		**mK**
	Freeze-to-freeze repeatability	0.02
	Total A	**0.02**
Type B		
	Hydrostatic-head	0.001
	SPRT self-heating	0.006
	Change in resistance of standard resistor	0.0001
	Bridge reading and non-linearity	0.003
	Immersion	0.006
	Moisture	
	Isotope variations	0.015
	Gas pressure	0.00001
	Total B	**0.017**
	Combined Standard Uncertainty	**0.026**
	Expanded Uncertainty (k=2)	**0.052**

Table IV.16. VSL uncertainties (k=1) for the fixed points, expressed in mK.

		Al	Zn	Cd	Sn	In	Ga	TPW	Hg	Ar
Type A		**0.65**	**0.34**		**0.31**	**0.29**	**0.116**		**0.18**	**0.32**
	DF	64	52	NA	118	42	92		128	64
Type B										
chemical impurities		0.387*	0.312*	0.274*	0.175*	0.079	0.115*	0.035*	0.012	0.029
plateau progress		0.115	0.115	0.115	0.115	0.115*	0.115	N/A	0.058*	0.058*
hydrostatic head error		0.009	0.016	0.026	0.013	0.019	0.003	0.002	0.020	0.019
bridge & standard resistors		0.015	0.020	0.023	0.027	0.032	0.011	0.013	0.015	0.024
Propagation TPW unc.		0.162	0.124	0.107	0.091	0.077	0.054	N/A.	0.041	0.010
SPRT self-heating		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heat flux		0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.060	0.030
Leakage resistance (moisture etc.)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
gas pressure		0.002	0.001	0.002	0.001	0.002	0.115	0.005	0.004	
insulation degradation		0.000	-	-	-	-	-	N/A	-	-
Total B		**0.42**	**0.34**	**0.30**	**0.20**	**0.12**	**0.17**	**0.05**	**0.08**	**0.05**
Expanded uncertainty (k=2)		**0.843**	**0.676**	**0.595**	**0.404**	**0.294**	**0.349**	**0.096**	**0.192**	**0.145**

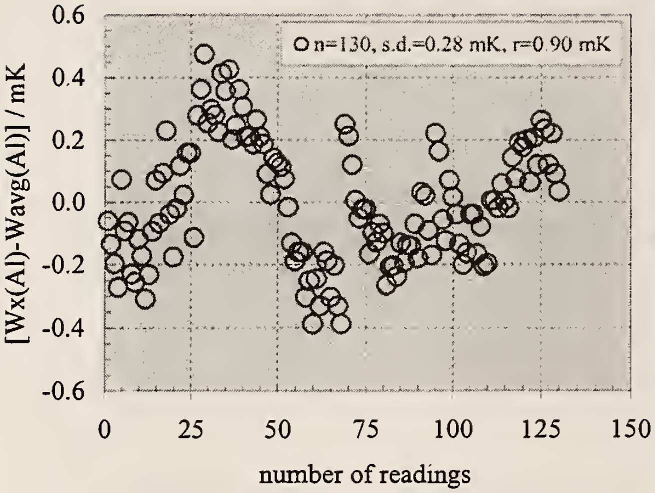
*NMi/VSL states "We choose to include the values from chemical impurities or plateau progress, whichever is the larger. We do not include both because these values have a strong correlation." The asterisk indicates which value (impurity or plateau progress) is used in calculating the expanded uncertainty.

Appendix V

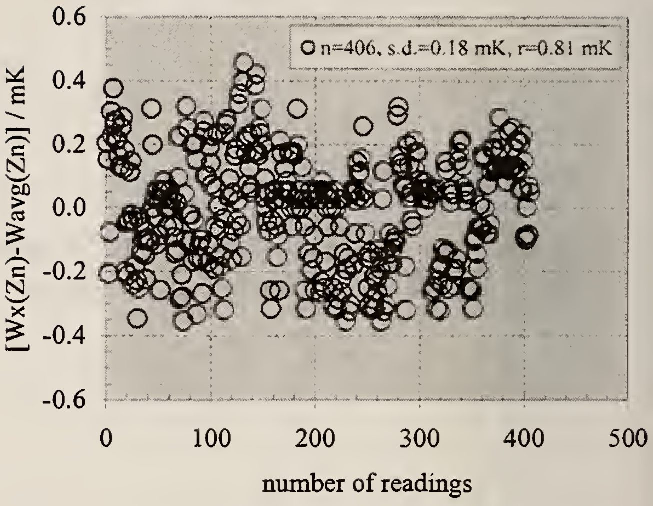
Control Charts

In this Appendix, we present the NIST control charts for the NIST check SPRTs in the fixed-point cells of Al, Zn, Cd, Sn, In, Ga, Hg and Ar.

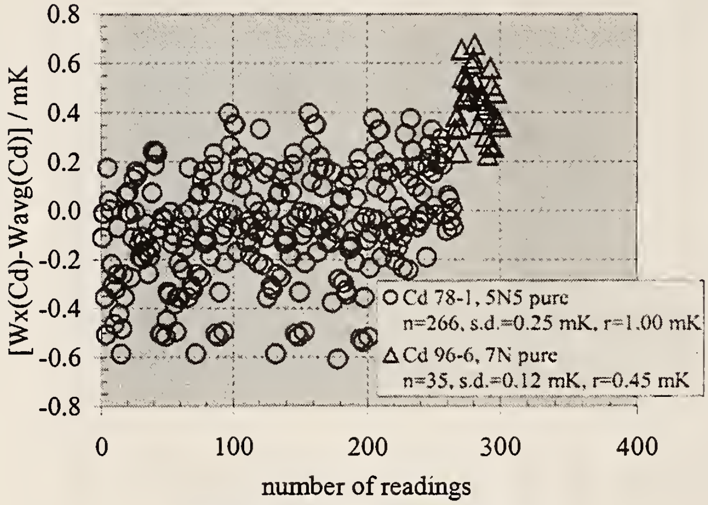
Control Chart for NIST Al FP Cell
Check SPRT 0033, ASL F18, 1 mA



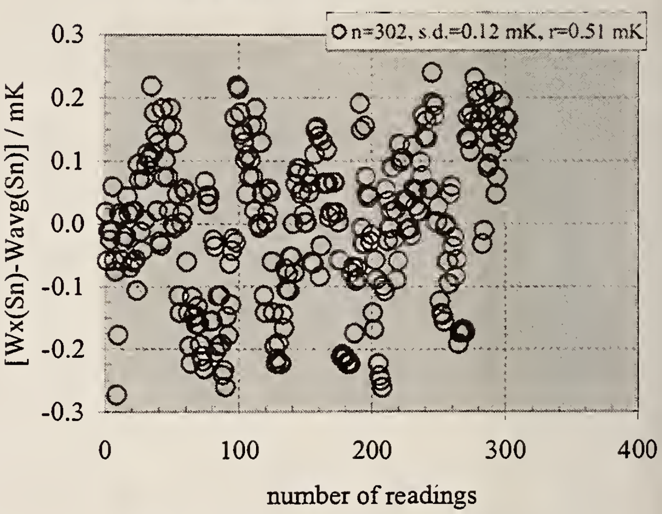
Control Chart for NIST Zn FP Cell
Check SPRT 0051, ASL F18, 1 mA



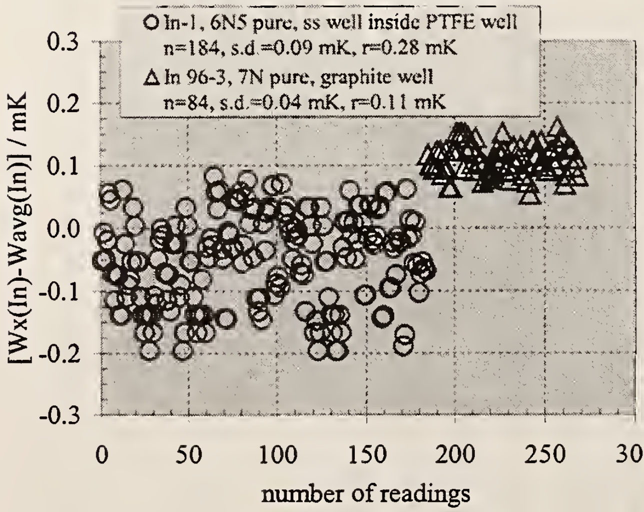
Control Chart for Cadmium FP Cell
SPRT 009, ASL F18, 1 mA



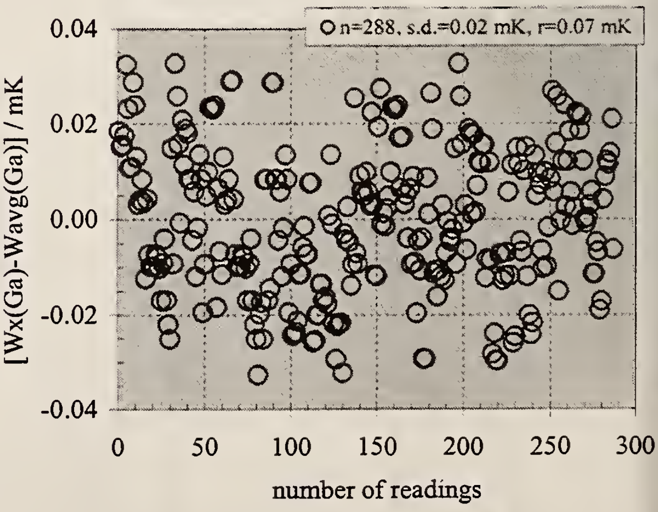
Control Chart for NIST Sn FP Cell
Check SPRT 004, ASL F18, 1 mA

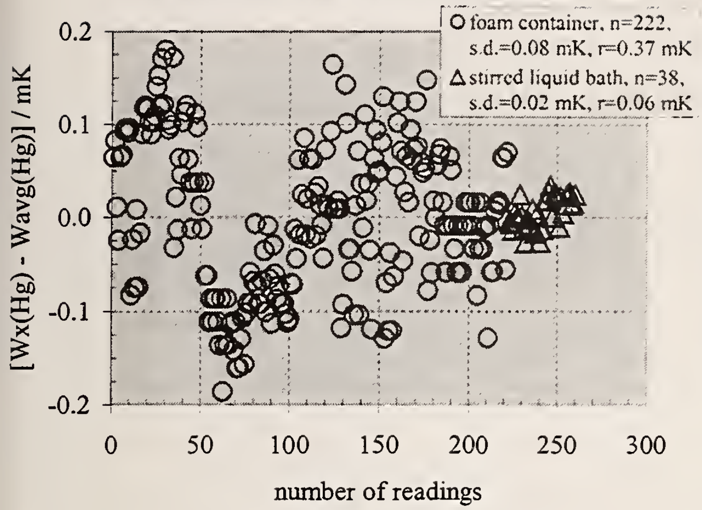


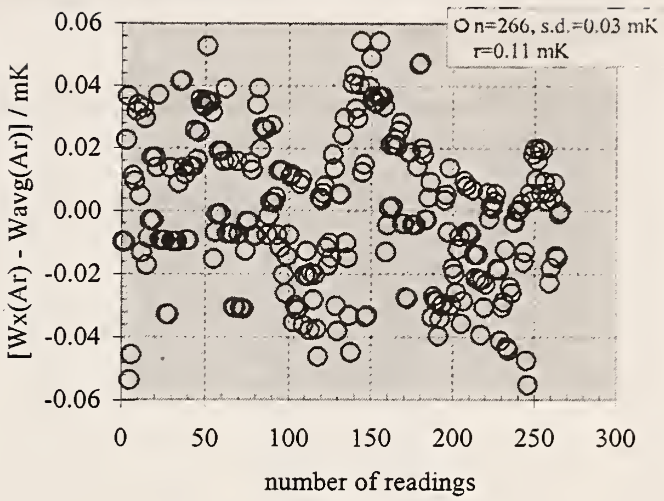
Control Chart for Indium FP Cell
SPRT 0041, ASL F18, 1 mA



Control Chart for NIST Ga TP Cell
Check SPRT 007, ASL F18, 1 mA




Control Chart for NIST Hg TP Cell
Check SPRT 007, ASL F18, 1 mA


Control Chart for NIST Ar TP Cell
Check SPRT 008, ASL F18, 1 mA

Appendix VI

Additional Tables

Table VI.1. Standard uncertainties for a single measurement ($n = 1$) for the fixed points used for the various participants.

		Al FP	Zn FP	Cd FP	Sn FP	In FP	Ga FP	Hg TP	Ar TP
BIPM	Type A (*k*=1, *n*=1) / mK						**0.05**		
	deg. freedom						9		
	Type B (*k*=1) / mK						**0.07**		
	deg. freedom						Inf		
	u_c (*k*=1, *n*=1), mK						**0.09**		
	deg. freedom						72.92		
	k for (95%)						1.99		
	U (95%, *n*=1) / mK						**0.18**		
BNM	Type A (*k*=1, *n*=1) / mK	**0.10**	**0.46**		**0.27**	**0.10**	**0.04**	**0.05**	**0.13**
	deg. freedom	5	5		5	5	5	5	5
	Type B (*k*=1) / mK	**1.12**	**0.45**		**0.46**	**0.32**	**0.15**	**0.28**	**0.28**
	deg. freedom	Inf	Inf		Inf	Inf	Inf	Inf	Inf
	u_c (*k*=1, *n*=1), mK	**1.12**	**0.64**		**0.53**	**0.33**	**0.15**	**0.29**	**0.31**
	deg. freedom	79935.37	19.14		75.78	605.00	1051.25	5580.61	155.51
	k for (95%)	1.96	2.09		1.99	1.96	1.96	1.96	1.98
	U (95%, *n*=1) / mK	**2.20**	**1.35**		**1.06**	**0.65**	**0.30**	**0.57**	**0.61**
IMGC	Type A (*k*=1, *n*=1) / mK	**0.47**	**0.27**	**0.15**	**0.10**	**0.15**	**0.05**	**0.04**	**0.19**
	deg. freedom	8	7	8	7	6	11	11	4
	Type B (*k*=1) / mK	**0.41**	**0.32**	**0.29**	**0.18**	**0.28**	**0.03**	**0.12**	**0.13**
	deg. freedom	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf
	u_c (*k*=1, *n*=1), mK	**0.62**	**0.42**	**0.32**	**0.21**	**0.31**	**0.06**	**0.13**	**0.23**
	deg. freedom	24.99	40.42	181.17	140.93	117.81	18.00	976.96	9.07
	k for (95%)	2.06	2.02	1.97	1.98	1.98	2.10	1.96	2.26
	U (95%, *n*=1) / mK	**1.28**	**0.85**	**0.63**	**0.41**	**0.62**	**0.13**	**0.25**	**0.52**
KRISS	Type A (*k*=1, *n*=1) / mK	**1.00**	**0.50**		**0.40**	**0.20**	**0.20**	**0.20**	
	deg. freedom	6	6		6	9	9	9	
	Type B (*k*=1) / mK	**0.48**	**0.38**		**0.23**	**0.32**	**0.04**	**0.06**	
	deg. freedom	Inf	Inf		Inf	Inf	Inf	Inf	
	u_c (*k*=1, *n*=1), mK	**1.11**	**0.63**		**0.46**	**0.38**	**0.20**	**0.21**	
	deg. freedom	9.11	14.82		10.49	112.03	9.81	10.52	
	k for (95%)	2.26	2.13		2.21	1.98	2.23	2.21	
	U (95%, *n*=1) / mK	**2.51**	**1.34**		**1.02**	**0.74**	**0.46**	**0.46**	
MSL	Type A (*k*=1, *n*=1) / mK		**0.89**		**0.35**	**0.20**	**0.01**	**0.09**	
	deg. freedom		1		2	1	3	1	
	Type B (*k*=1) / mK		**0.47**		**0.31**	**0.33**	**0.18**	**0.17**	
	deg. freedom		Inf		Inf	Inf	Inf	Inf	
	u_c (*k*=1, *n*=1), mK		**1.01**		**0.47**	**0.39**	**0.18**	**0.19**	
	deg. freedom		1.63		6.41	14.23	289715.30	21.25	
	k for (95%)		5.39		2.41	2.14	1.96	2.08	
	U (95%, *n*=1) / mK		**5.42**		**1.13**	**0.83**	**0.35**	**0.40**	

Table VI.1 (cont'd.). Standard uncertainties for a single measurement ($n = 1$) for the fixed points used for the various participants.

		Al FP	Zn FP	Cd FP	Sn FP	In FP	Ga FP	Hg TP	Ar TP
NIM	Type A (k=1, n=1) / mK	1.70	0.57	1.05	0.57	0.42	0.17	0.26	0.26
	deg. freedom	7	7	5	7	7	7	6	6
	Type B (k=1) / mK	0.70	0.39	0.44	1.54	0.34	0.25	0.14	0.11
	deg. freedom	262	25	34	2	33	29	43	30
	u_c (k=1, n=1), mK	1.84	0.69	1.14	1.64	0.55	0.31	0.30	0.28
	deg. freedom	9.62	14.39	6.85	2.84	17.67	33.15	9.64	8.03
	k for (95%)	2.24	2.14	2.37	3.29	2.10	2.03	2.24	2.30
	U (95%, n=1) / mK	4.12	1.47	2.71	5.39	1.15	0.62	0.67	0.66
NIST	Type A (k=1, n=1) / mK	0.28	0.18	0.12	0.12	0.04	0.02	0.07	0.03
	deg. freedom	129	405	35	301	83	287	259	265
	Type B (k=1) / mK	0.16	0.10	0.03	0.02	0.03	0.01	0.01	0.03
	deg. freedom	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf
	u_c (k=1, n=1), mK	0.32	0.21	0.12	0.12	0.05	0.02	0.07	0.04
	deg. freedom	227.00	693.58	39.51	317.95	202.64	448.44	269.68	1060.00
	k for (95%)	1.97	1.96	2.02	1.97	1.97	1.97	1.97	1.96
	U (95%, n=1) / mK	0.64	0.40	0.25	0.24	0.10	0.04	0.14	0.08
NML	Type A (k=1, n=1) / mK	0.50	0.21	0.15	0.09	0.06	0.04	0.02	0.01
	deg. freedom	120	180	180	180	180	180	180	120
	Type B (k=1) / mK	0.35	0.18	0.17	0.15	0.41	0.13	0.13	0.49
	deg. freedom	120	180	180	180	180	180	180	120
	u_c (k=1, n=1), mK	0.61	0.28	0.23	0.17	0.42	0.13	0.13	0.49
	deg. freedom	216.62	354.42	355.79	298.66	186.97	208.12	191.10	120.04
	k for (95%)	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.98
	U (95%, n=1) / mK	1.20	0.55	0.45	0.34	0.82	0.26	0.25	0.96
NPL	Type A (k=1, n=1) / mK		0.11		0.13	0.13	0.10	0.11	0.22
	deg. freedom		8		8	8	2	3	4
	Type B (k=1) / mK		0.43		0.35	0.33	0.20	0.18	0.33
	deg. freedom		Inf		Inf	Inf	Inf	Inf	Inf
	u_c (k=1, n=1), mK		0.44		0.37	0.35	0.22	0.21	0.40
	deg. freedom		2120.57		544.30	443.28	50.00	43.37	43.76
	k for (95%)		1.96		1.96	1.97	2.01	2.02	2.02
	U (95%, n=1) / mK		0.87		0.73	0.70	0.45	0.42	0.80
NRC	Type A (k=1, n=1) / mK	0.30	0.05	0.15	0.17	0.10	0.11	0.06	0.04
	deg. freedom	8	9	9	9	9	9	9	9
	Type B (k=1) / mK	0.43	0.13	0.12	0.34	0.09	0.06	0.05	0.15
	deg. freedom	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf
	u_c (k=1, n=1), mK	0.53	0.14	0.19	0.38	0.13	0.13	0.08	0.15
	deg. freedom	76.76	522.25	25.18	231.87	27.32	15.01	32.81	1281.76
	k for (95%)	1.99	1.96	2.06	1.97	2.05	2.13	2.03	1.96
	U (95%, n=1) / mK	1.05	0.27	0.40	0.75	0.27	0.27	0.15	0.30

Table VI.1 (cont'd.). Standard uncertainties for a single measurement ($n = 1$) for the fixed points used for the various participants

		Al FP	**Zn FP**	**Cd FP**	**Sn FP**	**In FP**	**Ga FP**	**Hg TP**	**Ar TP**
NRLM	Type A (k=1, n=1) / mK	**1.01**	**0.28**		**0.17**	**0.42**	**0.02**	**0.15**	
	deg. freedom	3	3		3	2	Inf	Inf	
	Type B (k=1) / mK	**0.80**	**0.87**		**0.37**	**0.38**	**0.11**	**0.26**	
	deg. freedom	Inf	Inf		Inf	Inf	Inf	Inf	
	u_c (k=1, n=1), mK	**1.29**	**0.92**		**0.41**	**0.57**	**0.11**	**0.30**	
	deg. freedom	7.94	342.15		106.59	6.60	Inf	Inf	
	k for (95%)	2.31	1.97		1.98	2.39	1.96	1.96	
	U (95%, n=1) / mK	**2.97**	**1.80**		**0.81**	**1.36**	**0.21**	**0.58**	
PTB	Type A (k=1, n=1) / mK	**0.30**	**0.15**		**0.15**	**0.20**	**0.05**	**0.05**	**0.15**
	deg. freedom	49	149		149	49	199	49	49
	Type B (k=1) / mK	**0.83**	**0.64**		**0.43**	**0.56**	**0.12**	**0.14**	**0.27**
	deg. freedom	Inf	Inf		Inf	Inf	Inf	Inf	Inf
	u_c (k=1, n=1), mK	**0.88**	**0.66**		**0.46**	**0.59**	**0.13**	**0.15**	**0.31**
	deg. freedom	3670.07	54952.79		12660.15	3829.13	9093.82	3829.13	880.90
	k for (95%)	1.96	1.96		1.96	1.96	1.96	1.96	1.96
	U (95%, n=1) / mK	**1.73**	**1.29**		**0.89**	**1.17**	**0.25**	**0.29**	**0.61**
SMU	Type A (k=1, n=1) / mK	**0.52**	**0.35**		**0.35**		**0.05**		
	deg. freedom	2	2		2		2		
	Type B (k=1) / mK	**0.36**	**0.36**		**0.41**		**0.09**		
	deg. freedom	Inf	Inf		Inf		Inf		
	u_c (k=1, n=1), mK	**0.63**	**0.50**		**0.53**		**0.11**		
	deg. freedom	4.44	8.52		11.22		35.81		
	k for (95%)	2.67	2.28		2.20		2.03		
	U (95%, n=1) / mK	**1.69**	**1.14**		**1.17**		**0.22**		
VNIIM	Type A (k=1, n=1) / mK	**0.89**	**0.89**	**0.89**	**0.45**	**0.45**	**0.11**		
	deg. freedom	4	4	4	4	4	4		
	Type B (k=1) / mK	**0.17**	**0.15**	**0.11**	**0.10**	**0.13**	**0.04**		
	deg. freedom	Inf	Inf	Inf	Inf	Inf	Inf		
	u_c (k=1, n=1), mK	**0.91**	**0.91**	**0.90**	**0.46**	**0.47**	**0.12**		
	deg. freedom	4.29	4.23	4.12	4.41	4.70	5.09		
	k for (95%)	2.70	2.72	2.74	2.68	2.62	2.56		
	U (95%, n=1) / mK	**2.46**	**2.47**	**2.47**	**1.23**	**1.22**	**0.30**		
VSL	Type A (k=1, n=1) / mK	**0.65**	**0.34**		**0.31**	**0.29**	**0.12**	**0.18**	**0.32**
	deg. freedom	64	52		118	42	92	128	64
	Type B (k=1) / mK	**0.42**	**0.34**		**0.20**	**0.15**	**0.17**	**0.10**	**0.07**
	deg. freedom	Inf	Inf		Inf	Inf	Inf	Inf	Inf
	u_c (k=1, n=1), mK	**0.77**	**0.48**		**0.37**	**0.33**	**0.21**	**0.20**	**0.33**
	deg. freedom	129.14	205.57		239.48	66.36	979.51	211.17	70.74
	k for (95%)	1.98	1.97		1.97	2.00	1.96	1.97	1.99
	U (95%, n=1) / mK	**1.53**	**0.95**		**0.73**	**0.65**	**0.41**	**0.40**	**0.65**

Table VI.2. Standard uncertainties quantifying potential changes in SPRTs (listed in column 1) that were used in KC 3. The associated degrees of freedom (*DF*) are given also.

SPRT		**Al**	**Zn**	**Cd**	**Sn**	**In**	**Ga**	**Hg**	**Ar**
1030A	u_{SPRT} / mK	**0.239**	**0.133**	**0.121**	**0.094**	**0.085**	**0.000**	**0.000**	**0.020**
	DF_{SPRT}	5.254	3.948	7.304	4.421	32.621	NA	NA	3.168
1030B	u_{SPRT} / mK	**0.239**	**0.133**	**0.121**	**0.094**	**0.085**	**0.000**	**0.000**	**0.020**
	DF_{SPRT}	5.254	3.948	7.304	4.421	32.621	NA	NA	3.168
1032	u_{SPRT} / mK	**0.000**	**0.000**	**0.124**	**0.128**	**0.085**	**0.048**	**0.000**	**0.000**
	DF_{SPRT}	NA	NA	4.793	5.129	20.093	26.104	NA	NA
1094	u_{SPRT} / mK	**0.000**	**0.000**	**0.114**	**0.000**	**0.057**	**0.000**	**0.000**	**0.000**
	DF_{SPRT}	NA	NA	4.063	NA	9.281	NA	NA	NA
1098A	u_{SPRT} / mK	**0.000**	**0.125**	**0.000**	**0.000**	**0.073**	**0.000**	**0.000**	**0.000**
	DF_{SPRT}	NA	2.290	NA	NA	14.977	NA	NA	NA
1098B	u_{SPRT} / mK	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	DF_{SPRT}	NA	NA	NA	NA	NA	NA	NA	NA
4385	u_{SPRT} / mK	**0.000**	**0.000**	**0.101**	**0.000**	**0.062**	**0.016**	**0.000**	**0.000**
	DF_{SPRT}	NA	NA	3.224	NA	10.689	2.900	NA	NA
4386	u_{SPRT} / mK	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.027**
	DF_{SPRT}	NA	NA	NA	NA	NA	NA	NA	3.733
040	u_{SPRT} / mK	**1.332**	**0.510**	**0.314**	**0.179**	**0.074**	**0.000**	**0.000**	**0.000**
	DF_{SPRT}	21.591	17.800	12.701	11.591	4.948	NA	NA	NA

Table VI.3. Actual coverage probabilities for expanded uncertainties with different coverage factors and different degrees of freedom.

Degrees of Freedom	Actual Coverage Probabilities for k=1	Actual Coverage Probabilities for k=2	Value of k Needed to Obtain 95% Coverage
1	0.500	0.705	12.706
2	0.577	0.816	4.303
3	0.609	0.861	3.182
4	0.626	0.884	2.776
5	0.637	0.898	2.571
6	0.644	0.908	2.447
7	0.649	0.914	2.365
8	0.653	0.919	2.306
9	0.657	0.923	2.262
10	0.659	0.927	2.228
.	.	.	.
.	.	.	.
.	.	.	.
60	0.679	0.950	2.000
.	.	.	.
.	.	.	.
.	.	.	.
Infinity	0.683	0.954	1.960

Appendix VII. Comments by Participants on Key Comparison Reference Values

The votes by the participating laboratories for and against the use of key comparison reference values for this comparison were as follows.

Participants opposed to the use of key comparison reference values

IMGC (Marcarino, Steur) - opposed to a KCRV
KRISS (Gam, Kang) - no KCRV
MSL (White) - no KCRV, but believes that position to be untenable
NIM (Yuning) - no KCRV, unbiased KCRV difficult to obtain
NIST(Mangum, Strouse, Guthrie) - strongly opposed to a KCRV
NMi-VSL (de Groot) - no KCRV, fixed points similar to Josephson volt and quantum hall resistance comparisons
NRC (Hill) - supports NIST's position. No KCRV.
NRLM (Arai) - no KCRV, impurities bias results
SMU (Duris) - no KCRV, WG should explain why K3 is an "exceptional case"
VNIIM (Pokhodun) - agrees with NIST. No KCRV

Participants in favor of the use of key comparison reference values

BIPM (Stock, Pello) - recommend a KCRV but will agree to the majority opinion
BNM-INM (Bonnier, Hermier, Renaot) - MRA requires a KCRV, proceed with the calculation
NML (Connolly) - KCRV required
NPL (Rusby) - KCRV required for Draft B
PTB (Tegeler) - KCRV required by MRA and in assessing Appendix C claims, but will agree to the majority opinion

Totals: 10 opposed to a KCRV, 5 in favor of a KCRV (BIPM and PTB will agree with the majority opinion).

The comments that were received from the participating laboratories regarding key comparison reference values for this comparison are given below. These comments have been extracted from e-mails sent to NIST.

BIPM (Stock, Pello) - As Terry wrote, the KCRV is part of the MRA which was discussed and signed by your directors, and so the idea of KCRVs should no longer be questioned principally. In paragraph T.3 of the MRA it is stated that 'in exceptional cases' for 'technical reasons' the results of a KC can be expressed without reference to a KCRV. From this it is clear that the use of a KCRV is to be considered as the norm and indeed a number of KCs has reached final status expressing the results as d.o.e. with a reference value.

If the calculation of a KCRV is to be considered as the norm, it will be useful to think about its significance. Clearly, there are two distinct purposes: First, a reference value allows to represent the equivalence of laboratories in a concise way without loosing any information and without wasting too much paper. For this purpose, the actual choice of the reference value is completely arbitrary in that the differences between pairs of laboratories are always the same. In former years (before the MRA) in most cases the results of the pilot laboratory were used as a common reference. This could of course still be done today, but due to the gain in importance a 'neutral' reference value would nowadays appear as a better choice. This could be the simple (unweighted) mean, the weighted mean, the median, or any other statistical indicator.

The second purpose of a KCRV is to provide a 'close, but not necessarily the best, approximation to the SI value'. Here of course, the technique to determine the KCRV becomes crucial and it is up to the expertise of the CCT to choose. It would even be possible to use a KCRV only to represent the results in a simple way, without giving it a physical significance.

In our opinion, there is clearly no reason against the use of a KCRV in the first sense, that is, to represent the results of KC3 in a concise way. There is no simpler way to represent the results of a large-scale comparison: one graph per fixed-point which shows all results at the same time. If the results are presented in a form which is too difficult or too time-consuming to understand there is the danger that they are not used at all. Seen the limited time left, we would propose as KCRV the simple mean which avoids discussions about the validity of the estimated participants' uncertainties, needed for the weighted mean. WG 7 seems to us the best place where this discussion should take place. The meaning of a KCRV in its relation to the defined temperatures of the ITS-90 needs more consideration. This question was addressed briefly by Ken. Our opinion is that the defined temperatures of the ITS-90 with their zero-uncertainty, are applicable to 'ideal' realizations of the corresponding fixed-points. Since the isotopic composition of the samples is not defined, already from this (incomplete) definition of the ITS-90 a variation in the temperature of different ideal cells results. The best way to resolve this problem is to collect a large number of fixed-point cells and to assign the ITS-90 value to the mean of these cells, some cells giving slightly higher, some slightly lower temperatures. In addition there are temperature differences due to non-perfect realizations of the fixed-points due to impurities etc... Again, one way to solve this problem is to assign the ITS-90 value to the mean. If a model exists about the effect of the impurities, this information can of course be included, and the ITS-90 value could for example be assigned to the highest temperature. There really is no paradox in that all laboratories realize the (same) defined ITS-90 fixed points, but find different temperatures. The reason is simply that no realization is perfect, they all have uncertainties. If this were not so, why do we perform comparisons? To summarize, we would opt for the calculation of a KCRV, for two reasons: First it is required by the MRA and we see no reason which would exclude it under clause T.3 of the MRA. Secondly, it really facilitates the representation of the results of a key comparison.

(Stock) - The calculation of the pair-wise differences and the corresponding uncertainties depends not at all on the use or the special choice of a reference value. The only thing you need for this is a common reference, normally the pilot laboratory, which allows to compare everyone's results. The decision to introduce a reference value, calculated by one way or the other, to represent the 'unilateral' results, does in no way influence the bilateral results.

We also think that the treatment of asymmetric errors is a problem which is not specific to the calculation of reference values. This problem occurs whenever you have to give the result of a measurement in the form result +/- uncertainty, so in every calibration certificate, etc. So this problem has to be discussed anyway, not only in the context of key comparisons.

BNM-INM (Bonnier, Renaot, Hermier) - As it was recalled by Terry Quinn and some others, the MRA is henceforth signed up and, as a consequence, almost any Key comparison must be associated to a KCRV. The time for discussing the interest of KCRV is now over and we have, consequently, to turn our attention toward the calculation of its value.

The very difficulty is to find out a method for calculating an unbiased and neutral KCRV value. To avoid a large and somehow incoherent (web) discussion we should be glad if the relevant CCT working group was taking the charge of establishing a suitable method.

IMGC (Marcarino, Steur) - IMGC opposes to a KCRV, but will agree to the opinion of the majority.

KRISS (Gam, Kang) - KRISS oppose to a KCRV, but will agree to the majority opinion.

MSL (White) - (1) It seems to me that most of the dis-ease/ill-health associated with the KCRV has to do with the MRA statement that the KCRV "is a good but not necessarily the best representation of the SI". This is for many comparisons an untestable assertion. For some cases (including KC3) it is clearly incorrect. However MSL's main objection is that the statement carries a sense of BIPM approval of the value as a single point of traceability for all measurements on that scale, i.e. replacing the SI. (MSL has always held the view that the statement should be removed from the MRA.)

(2) In all but a few comparisons (e.g. where the value of the artifact is known through independent measurements) a choice of KCRV based only on the measurements submitted to the KC is completely arbitrary. (See the paper submitted as CCT/2000-2 for rationale). In KC3 for example we could freely choose the NIST value for any one of seven thermometers, or the results of any other laboratory - any number will do. (In this context assigning an uncertainty to KCRV is also nonsense)

(3) Following (2): in order to define a KCRV information/data external to the comparison has to be employed. For example the 10pF comparison of the CCEM recognized that only a few laboratories have calculable capacitors, which do realize the SI Farad. Therefore the KCRV was based on a weighted average of their results only. In this case the KCRV does reflect in some sense the best knowledge of the SI Farad. Note, external information is required to give meaning to the KCRV and hence to help identify a procedure for calculating the KCRV.

(4) KC3 has little to do with the SI (the unit kelvin). KC3 has compared (indirectly through SPRTs) the realizations of several natural physical phenomena (the melting and freezing points) held by the various NMIs. Any W values we measure and the W value we might choose for a KCRV are dimensionless ratios, and the observed ratios and differences are quite independent of definition of the kelvin or ITS-90.

(5) The nature of the uncertainties and errors in our W values are such that we expect a tendency for laboratories with the lowest uncertainties to have the highest W values. I'm not aware of any statistical treatment that can provide a 'best value' from such data. (Perhaps we should in future apply corrections for impurities?)

(6) I am reassured by the conspicuous lack of status accorded the KCRV in the KC reports published on the BIPM web site. In some cases a numerical value is not given.

NIM (Yuning) – 1.NIST method give the results clear enough. 2.How to get a KCRV without bias is very difficult not only for K3 but also for some other KCs. In this case NIST method is more objective.

NIST(Mangum, Strouse, Guthrie) - Our line of thinking focuses on the fact that to compute a reasonable KCRV in a key comparison in which different laboratories have made measurements using non-identical transfer standards, the data must first be normalized to a common basis. The normalization of the data usually introduces correlations between different laboratories' results, and this complicates the computation of the uncertainties of the pair-wise differences between the laboratories. For the users of KC 3 to be able to make these complicated and unfamiliar calculations, an extra correlation matrix would be required to obtain correct bilateral uncertainties. This certainly lessens the value of using a KCRV. ... We are also in agreement with the analysis presented by Alan Steele that shows that reasonable methods of computing a KCRV can yield qualitatively different results for apparent agreement between particular laboratories and the KCRV.

NMi-VSL (de Groot) - The assumption that NMi-VSL was not objecting to the position of NIST: no KCRV, is correct. We understand the arguments of NIST against it as that it shall generate a lot of work (and a big delay in the processing of draft B) and that fixed points key comparisons do not allow for a key comparison reference value. The latter argument could fit in the exception clause T.3 of the technical annex of the MRA....So, back to the KCRV. I understand the argument of NIST to be that fixed points have a distribution that does not allow a simple KCRV. Mainly, I think this is because comparisons we have had so far do not give enough information about the distribution between fixed points. We do not know the underlying statistics well enough to be able to choose a KCRV that we think is acceptable for a good indicator for an SI value. For this, we argue that the fixed points are defined for pure substances. In the ITS-90 only reference is made to isotopic composition being "natural". The supplementary information (section 2.2.2) refers to metal ingots that must be 6N pure to achieve "the highest possible accuracy". The statement that I so often hear, that the ITS-90 is defined only for pure materials, is something I do not necessarily read in it, though one must argue that this is the implicit background of the definition. In a way, the statement in T.4 of the MRA supplement it says that "in some chemical measurements, there may be difficulty in relating results to the SI. Discussing this with Marten Durieux we thought that perhaps only if in the report of the key comparison the reference value is defined in terms of being an average of a number of highest accuracy realizations of the reference points and to specifically state that reference to the SI value is not possible because of the unknown statistical part involved, we could find a leeway out of this problem? However, in this case we are not looking at a pure comparison of fixed points, but it is through travelling SPRTs, except for gallium and cadmium. This use of SPRT as a transfer for most of the fixed points involved could (I think) undermine the applicability of clause T.3 and most of what I wrote here. On the other hand, the added uncertainty of the SPRT could well be a dominant term in the inter-comparison and than we find that the SI is not well enough approximated by the results this key comparison. As to other fields, I found Key Comparison Reference Values have not been applied yet in the case of the comparison of Josephson standards or of the Quantum Hall standards. I consider this to be equivalent to our (fixed point) case. I understand from my colleague in this field that the CC-members are not charmed by the idea of a KCRV. I suppose it is based on the same fear that seems to dominate our field. I think that the pilot representing all the participants has to be supplied with good arguments in support of its position so that, when we sit round the CCT-table and debate the report of K3, it shall be very clear that this case is an exception as meant by those writing the MRA. As it is now, I see that we might have not enough arguments or at least they have not been summarized clearly enough. So either we have to find some more or clearer arguments, or we have to ask NIST to rewrite and recalculate the data to include a KCRV, which I can imagine to be a very extensive job, almost as large as analyzing the data so far. I can understand and sympathize with the NIST position. Probably we are in this position because NIST has been very active and soon in processing the data and while doing had to make assumptions on the MRA: they expected it not to include a KCRV. As the MRA appeared in its present form this proved to be wrong. I think that the arguments so far are only just enough to possibly validate this as an exception to the clause in the MRA. It is the SI-relation of the KCRV that is worrying me a bit.

NRC (Hill) - It seems to me that this "significant unresolved deviation from the key comparison reference value" issue can be avoided by following the "no KCRV" approach. Otherwise, it appears that we must hope that our uncertainties overlap the KCRV, however defined, or risk having either to withdraw our cmc's from Appendix C or increase our uncertainties. This reinforces the point of view that the KCRV represents the "correct" value which we must try to achieve and further raises the spectre of whether we should realize the ITS-90 according to the ideal of the definition, or whether we are forced to seek the "consensus value" represented by the KCRV.

NML (Connolly) - On the KCRV question I personally do not have a problem with no KCRVs being specified in the report. My view is that if one wants a reference to difference off one can achieve this by just eyeballing a graph. I have not been able to obtain his (Director of NML) view on the interpretation of Page 31 in the MRA. However I am sure he would not insist on us holding up publication of the report if the majority favours the exclusion of KCRVs.

(Ballico) - Whilst I am not a fan of KCRVs on scientific grounds, I think it is worthwhile to consider two other points that users will have in favour of KCRVs.

(1) It will make life a lot easier for RMOs to link their regional-key-comparisons to the key-comparisons. i.e. without KCRVs I'm not sure how to do it at all (short of a huge matrix). If its clear to anyone I would appreciate some comment.

(2) As a member of the APMP-CMC review committee I will require a simple, single value performance indicator for review of CMC entries. If one is not made available, I may need to generate it. Other CMC reviewers will be in a similar position.

NPL (Rusby) - First, it is stated in the MRA that key comparisons lead to the derivation of a KCRV (paragraph 4 of the preamble and Clause T1), so if we do not do this, we are asking for an exemption. If NIST presents Draft B (or a summary of it) to the CCT without deriving KCRVs, there will some obligation to give reasons.

Second, I presume that since defining KCRVs is expected to be the norm, arguments for not doing so are likely to be effective only if there is some overwhelming scientific or technical reason for not doing so. I don't think the argument that they may be misleading or misused will carry any more weight in our case than for other comparisons.

Third, as a point of procedure, CCT WG7 and then the CCT itself will debate the report and decide whether to approve it, and it will no doubt consider the question of whether KCRVs should be defined and if so how. In fact the question was raised at the CCT meeting in April but the discussion was interrupted and has not been resumed, apart from Terry's explanatory note of 28 April. In it he points out that 'the method chosen for calculating the KCRV is a matter for the participants in each comparison, but in each case the decision must be approved by the key comparison working group and, in due course, by the Consultative Committee'.

In summary, we will be expected to produce KCRVs unless there are convincing reasons why we should not. I personally think they will at least have some convenience in providing baselines for the comparison, whatever 'health warnings' may be needed about their misuse. As it is, the essential results of CCT-K3 are as given in Tables 21 to 28, but to represent them graphically (as we should do) requires 15 graphs per fixed point. A KCRV would reduce this to one.

Finally, I have some difficulty with the view that ours is a special case because of the symmetric probability distribution of uncertainty. If this is a problem, we have largely ignored it up to now, in that we routinely issue calibrations to customers using the defined ITS-90 values and normally distributed uncertainties. I think there is an analogy here. To sort it out we may need some statistical dexterity (but it will never be fully rigorous). Otherwise we can hardly object to defining KCRVs by a conventional method.

NRLM (Arai) - Among the several reasons, we consider that the following point is the most important: Calculating the simple (or the weighted) mean, without taking account of the effect of the impurities in the material of the fixed point used in the Key Comparison, would definitely not reduce the bias caused by the impurities, and is physically meaningless.

PTB (Tegeler) - I would like to explain shortly why PTB has changed its position and is now in favour of a KCRV. I still think that from a metrological point of view there is no need for a KCRV, and I also see the danger that it may be misleading.

But to my present understanding of the MRA, key comparisons are not primarily a tool for the improvement of temperature metrology, but an instrument to establish international equivalence of measurements under regulations described in the MRA and its appendices.

My interpretation of the MRA is that key comparisons can only be included into the key comparison database if there is a KCRV with an assigned uncertainty. Only on the basis of this information the RMOs and the JCRB can judge the calibration and measurement capabilities of the NMIs.

So without the KCRV there might be no accepted CMCs in the Appendix C of the MRA. This would fundamentally undermine the idea of the MRA, and I think all doubts from the metrological viewpoint are not worth the struggle that would arise if there are no CMCs. At least in Europe the consequences for the traceability of temperature measurements between countries and also between NMIs and accredited laboratories would be a catastrophe.

If my interpretation of the MRA is correct, I think we should accept that there has to be a KCRV. But of course it is the decision of the participants how the KCRV and its uncertainty will be calculated. My proposal is the weighted mean with a cutoff.

SMU (Duris) - We suppose that now the NIST position is acceptable (no KCRV). We are afraid that now it is late and not very important to open the discussion concerning the KCRV for the publishing of draft B. It would be the big job (with doubt of its meaning) and at present it will cause the delay of the presentation of the results. Of course that it (no KCRV) is the situation of the "exception". We are afraid that for "correct" evaluation of the KCRV there are not enough information and we were not ready for it in the beginning of the measurement. There is also the question that there is not the physical significance of this value.

VNIIM (Pokhodun) - I shall try once again to explain the absence of scientific grounds for KCRV for ITS-90.There is a thermodynamic scale and its approximation ITS-90. Each time, when improving the ITS we are trying to make it closer to the thermodynamic scale and to improve its smoothness. Each NMI tries to reproduce the ITS-90 as close to the ITS determination as possible. After the introduction of the KCRV the NMIs will strike to approach to KCRV, but not to the ITS-90 determination. Thus, the introduction of KCRV will replace the ITS-90 by some function, that has neither physical nor scientific grounds. I think that KCRV is a random function at an extremely small number of realizations. That is why if is not possible to speak about the best approximation of KCRV to ITS-90 and moreover after approval of KCRV to speak about the scale smoothness and its joining with other scale intervals. Moreover, the comparisons of each reference point result in a set of W values of, obtained in measurements. The value of some individual thermometer (weighted mean or other mean value) cannot be considered as KCRV of a particular reference point. We have to assign to the above W value the temperature value according to ITS-90, that cannot be considered as KCRV. The weighted mean value W (or some other mean value W defined by some other way) can be used only for determination of the mean line calculated from the results of measurements carried out by all NMIs and then for evaluating deviations of the NMIs results from this mean line. So, where is KCRV here? In which form do we hope to get it, and in what units? Everything, that has a real base in comparisons of reference point, are the deviations of results obtained by each NMI, from the mean line with the uncertainty value these deviations. The KC3 is over earlier that the document MRA was signed by NMI directors. I consider that this circumstance is a reason of the arisen problems. I think that it is not possible to neglect the metrology because of not perfected official document (MRA).

Letter from NIST concerning deferment of K3 KCRV (12/01/00):

Dear Key Comparison 3 Participants:

We have reread all of the recent correspondence on the definition of a KCRV for Key Comparison 3. In this letter, we propose a course of action that we hope the participants can adopt as a consensus position.

First, let us summarize the results of the polling conducted by Ken Hill. Of the 15 participants, 10 are opposed to a KCRV and 5 are in favor. Of the minority 5, at least two will defer to the majority vote. Consequently, a position of strictly no KCRV does not appear to meet the requirement of consensus, which is the absence of significant, sustained opposition. In brief, the arguments for and against a KCRV are as follows.

Arguments for a KCRV
1. The MRA mandates the use of a KCRV, especially for the purpose of computing "significant unresolved deviations" between the results of an individual laboratory and the KCRV.
2. The display of data in Appendix B and in publication in the open literature is simplified.

Arguments against a KCRV
1. There are significant differences in the KCRV value depending on the choice of the KCRV definition, and there is insufficient information to determine the best choice of the definition.
2. If a KCRV is used, a statistically valid calculation of the uncertainty between laboratories requires a relatively complex correlation matrix, eliminating the simplicity of presentation intended by introduction of a KCRV.
3. The asymmetric errors resulting from impurities in fixed-point cells introduce a bias that is hard to remove from any definition of a KCRV.
4. There is a risk that any KCRV will be interpreted to have a physical meaning that is inappropriate and misleading.

These summaries are not inclusive of all arguments for and against a KCRV, and we refer you to the extensive correspondence for a full statement of all of the arguments for and against.

It is clear to us that a strong majority favors the absence of a KCRV, but it is also clear that consensus for this position will be difficult to obtain. Our highest priority is completion of K3, and with this in mind, we propose the following approach as a compromise:
1. The final Draft A report will not have a KCRV. The report will contain all of the figures and tables that have previously been sent to you.
2. For publication in the open literature and in Appendix B of the MRA (through the BIPM website), the data of the comparison will be presented as a bilateral table of differences, with

associated uncertainties, and a single plot with no identified baseline, such as the sample shown by Alan Steele for aluminum.

3. Following adoption of Draft B of the report by the CCT, the question of defining "significant unresolved deviations" will be addressed by the body deemed most appropriate for the task by the CCT. If a KCRV proves necessary for the purpose of identifying "significant unresolved deviations" or for other purposes related to the MRA, as identified by the CCT, one will be generated at that time. As the pilot laboratory, NIST will perform the calculations of such a KCRV if requested to do so.

As documentation of the discussions that have taken place, we also suggest that the e-mails stating the positions of each participant be placed in an appendix to the final Draft A report. This appendix would serve as a starting point for further discussions.

This approach has several advantages:

1. Completion of K3 will be as prompt as possible, enabling data entry into Appendix B.
2. With the data complete and agreed upon, there is no temptation for participants to alter uncertainties or data to "cover" their deviation from a KCRV.
3. Neither the CCT as a body nor the K3 participants have considered how "significant unresolved deviations" are to be defined. In the event that this discussion is lengthy, the discussion will not impede publication of the K3 results.

At this point, we need each of the participants to respond back to us by Monday, November 20th, 2000, stating whether they can or cannot accept this proposal. If we do not receive a response, we will interpret that as agreement with this proposal. If consensus cannot be obtained, we fear that the matter will not be resolved until the next CCT meeting in September of 2001. A delay of this length would be very unfortunate and counter-productive.

We thank Franco Pavese and Ken Hill especially for their efforts in clarifying both the content of the MRA and the positions of all the participants. We thank the participants for all of their contributions to this discussion, and we look forward to receiving your positions on this proposal.

Letter from NIST to participants (12/14/00) giving results associated with the NIST letter of 12/01/00 on a proposed course of action.

Thank you to those participants who responded by the deadline (12/12/00) to the e-mail dated 12/01/00. Based on the vote, the steps outlined in the e-mail dated 12/01/00 concerning the KCRV will be followed.

K3 Participants in favor (by e-mail vote) of above approach to KCRV in K3:

BIPM, BNM-INM, IMGC, MSL, NIST, NML, NPL, NRC, NRLM, PTB, VNIIM and VSL

K3 Participants in favor (by no response) of above approach to KCRV in K3:

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